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AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS

VOLUME XII MAY 7, 1923 NUMBER 10

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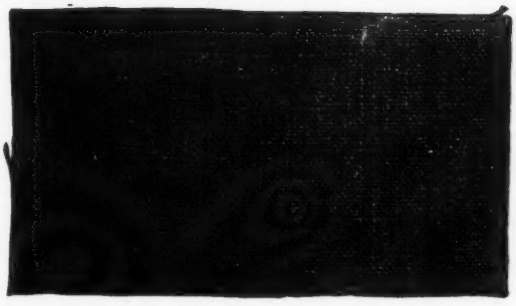

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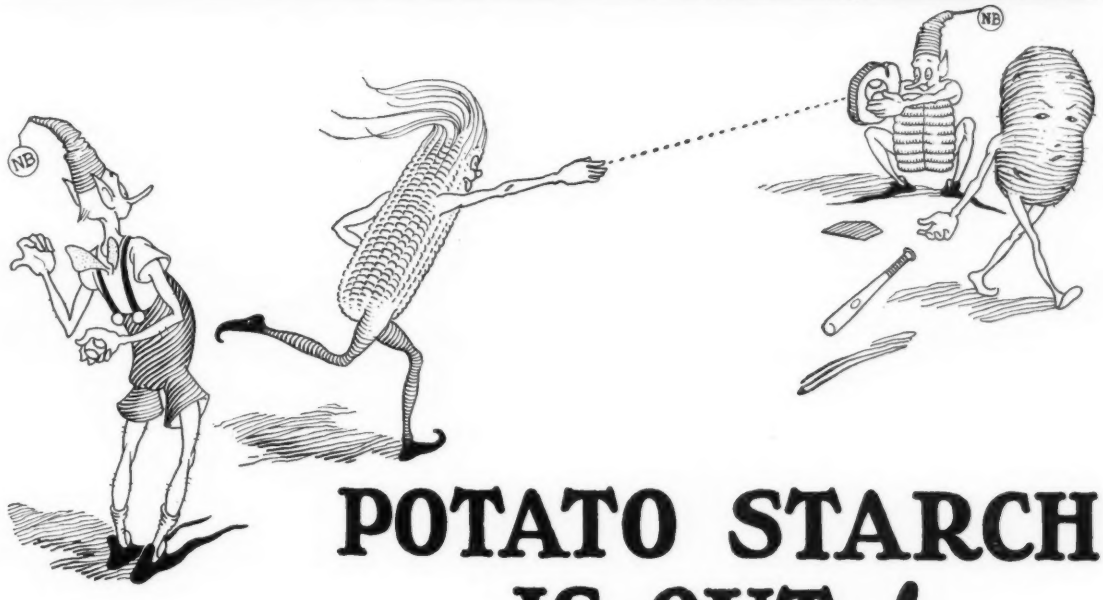

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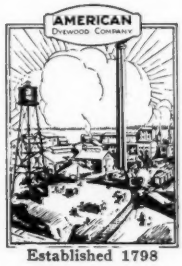

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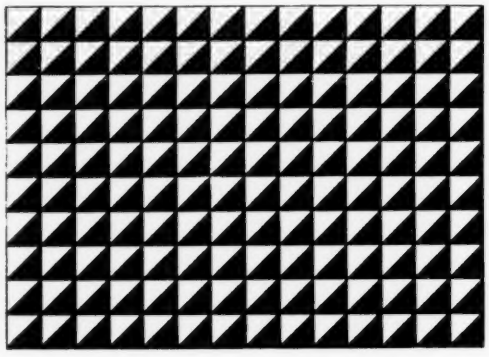

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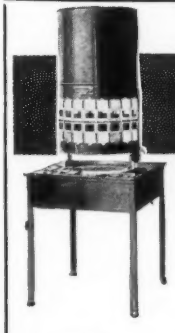

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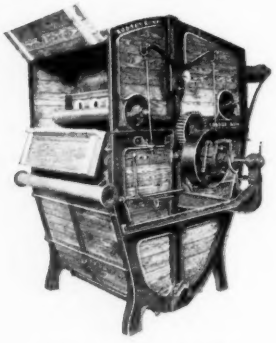

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VOLUME XII NEW YORK, MAY 7, 1923 NUMBER 10

Notes on the Dyeing of Direct Blacks on Cotton Piece Goods

Part VI

Dyeing Half Wool Goods—Preliminary Treatment—Advantage of Direct Blacks for Half Wool Goods—Dyeing Processes—Various Factors Influencing the Dyeing—One Bath Dyeing Process—Correcting Shades—Dyeings Fast to Milling—The Two Bath Process—Plant Required—Operation of Such a Plant—Apparatus for Opening Out Chains of Cloth—Operation and Advantages

By RAFFAELE SANSONE

(Part V of this series appeared in the issue of January 29, page 95.)

Dyeing Half-Wool Goods

THE dyeing of cotton and wool goods with direct blacks, for producing grays, blacks and mode shades, is more extensively conducted than many may think, especially as colored half-wool goods are more largely manufactured than the pure wool goods, owing to their easier sale to a consuming public always on the look-out for reasonably priced goods, and who, providing the articles purchased have have an agreeable appearance, are not disposed to be over-critical if an all-wool guarantee does not accompany their purchases.

The task of the dyer in this instance is, however, anything but simple, for even when he has at his disposal the most suitable coloring matters—which may not always be possible—the production of the required shade, on both the cotton and the wool of the material being treated, can give some trouble, it being easy to dye either the wool or the cotton contained in the material too dark, producing less perfect goods. This danger is greater in the production of light and mode shades than in the production of blacks, for in the latter case a small difference in the shade of the two materials is not so easily visible.

Treatment Preceding Dyeing Operations

Through the use of dyestuffs of known strength and properties, the adoption of a definite method of working, that is kept always the same, and a suitable preparation of the material to be treated, matters can be greatly assisted, much reducing the above danger, and rendering the work of the dyer easier and simpler.

Many half-wool fabrics sent in to the dyer require before their coloring a certain amount of cleaning or purging, especially when the material contains portions of soap or fat residues, as is often the case with lower class goods. These residues can cause an irregular penetration of the dyestuff, or, in the case of acid coloring matters, can hinder the production of the desired shades, so that the former, even after a prolonged boiling, are not sufficiently absorbed by the wool in the half-wool goods.

Soap residues are easily removed by treatment with boiling water, as these can be easily dissolved by the same, acting then as lisciviating agents. Fat residues can be removed by washing at 40 deg. Cent. with a bath containing a small quantity of ammonia or carbonate of soda.

The decoloration of the material is only conducted in some special cases, and especially when light coloring matters are to be dyed. This is accomplished by boiling for thirty minutes with 10 per cent sulphuric acid, by itself or with the addition of 3 per cent of bichromate of potash. With light shoddy wool a boiling with sulphuric acid by itself is sufficient; the darker shoddy wools, however, require a boiling with sulphuric acid and bichromate of potash.

A prolonged boiling must in all cases be avoided, or a portion of the coloring matter and impurities taken off goes back again to the wool in another form. After the bleaching the acid is eliminated in the goods through the addition of some carbonate of soda or ammonia, and through a thorough rinsing. The acid, if left in the material, would reduce its affinity for cotton dyestuffs.

Advantages of Direct Blacks for Half-Wool Goods

The advantages possible when using direct blacks for the dyeing of cotton and wool goods in piece form are many, and are well worth considering at the present moment. Some of them are as follows:

1. Direct blacks dye both the wool and cotton of the fabrics, often exhausting the dye baths better than if only wool or only cotton were dyed with the same.

2. Such blacks can be employed for a partial coloring of one or both fibers, saving on the employment of other colors.

3. A weak black or old black bath can be employed for dulling both materials, or only one of these.

4. The blacks can be used for dyeing the cotton only, when the wool is already dyed, producing a full black on the cotton, and completing the production of the black on the wool, etc.

The Dyeing Processes

Half-wool piece goods can be dyed by the one bath, or by the two bath process. Both processes, if properly applied, give very good results; their success depends, however, very greatly on the choice of the most suitable dyestuffs, on the plants available, and the ability of the dyer himself. The one bath process is the more simple and rapid of the two, and is generally employed when the goods contain large quantities of cotton. It is principally adopted when no special fastness to washing and milling is required.

The one bath process is based on the fact that substantive dyestuffs dye in a neutral bath both the wool and cotton fibers. The affinity to the vegetable and animal fibers is, however, very different with the various substantive coloring matters, as some of these dye the cotton stronger than the wool, while others dye both fibers in nearly the same intensity and shade, and others dye the wool deeper than the cotton. The preference should, however, always be given to those colors that dye cotton darker than wool. As assistants in the dyeing and shading of the wool portion of the fabrics, the acid colors are employed which, in a neutral boiling bath cover the former well, leaving the cotton almost uncovered or completely so.

Many substantive coloring matters have, at temperatures below the boil (100 deg. Cent.), the tendency to dye the cotton portion of the material more than the wool. Through the lowering of the temperature the affinity for the cotton can thus be increased with some colors which, even if dyeing the wool deeper at the boil, leave it in the cold nearly uncolored. For this reason the temperature of the dyeing operations has to be regulated in accordance with the colors used and effects sought.

Various Factors Influencing the Dyeing

It sometimes happens that after a treatment in a boiling dye bath the cotton remains too lightly colored. For darkening the shade in this case steam is turned off, and the material is treated further in the cooling down bath; the substantive colors that also dye the material in the cold are, however, the only products that can be used.

The concentration of the dye bath also plays an important part in the dyeing of half-wool goods. The more concentrated the bath is, the more easily the cotton in the material be covered. As a rule, the bath is made up with twenty to fifty times the weight of the material of water, the contents of crystallized sulphate of soda being kept between five and twenty grams per liter of bath. For producing blacks the largest amount of the salt is used, and for light colors or grays the weaker. When dyeing with direct steam a greater amount of sulphate of soda is employed than when dyeing with indirect steam. The salt should only surpass the proportions indicated in exceptional cases.

Through the addition of about one-half per cent of borax or carbonate of soda the affinity of the coloring matter for wool is reduced. In certain dye baths a similar addition is found beneficial, but not in all. The addition of a little acetic acid raises the affinity of the coloring bath for the wool, and is generally used when, after the boiling, the wool has not been sufficiently colored.

One-Bath Dyeing Process

The half-wool piece goods that have to be dyed have a very different content of cotton and wool, there being more cotton than wool, more wool than cotton, or equal portions of both fibers. As, however, the cotton in the material requires for its covering a certain amount of dye bath, it will be necessary to prepare the bath for goods that have comparatively little cotton with about as much cotton color as with the material that contains a much larger quantity of cotton. The most satisfactory proportion of bath to material for the dyeing of cotton with substantive coloring matters is one to twenty-five. With the goods that are composed one-half of cotton and one-half of wool twenty-five times the weight of material of dye bath is also required, representing for the cotton in the material a proportion of one to fifty. When less cotton is present in the half-wool goods the proportion of dye bath is increased further requiring more and more coloring matter for obtaining a sufficient covering of the cotton. For this reason with small quantities of cotton a strong excess of direct coloring matter is necessary.

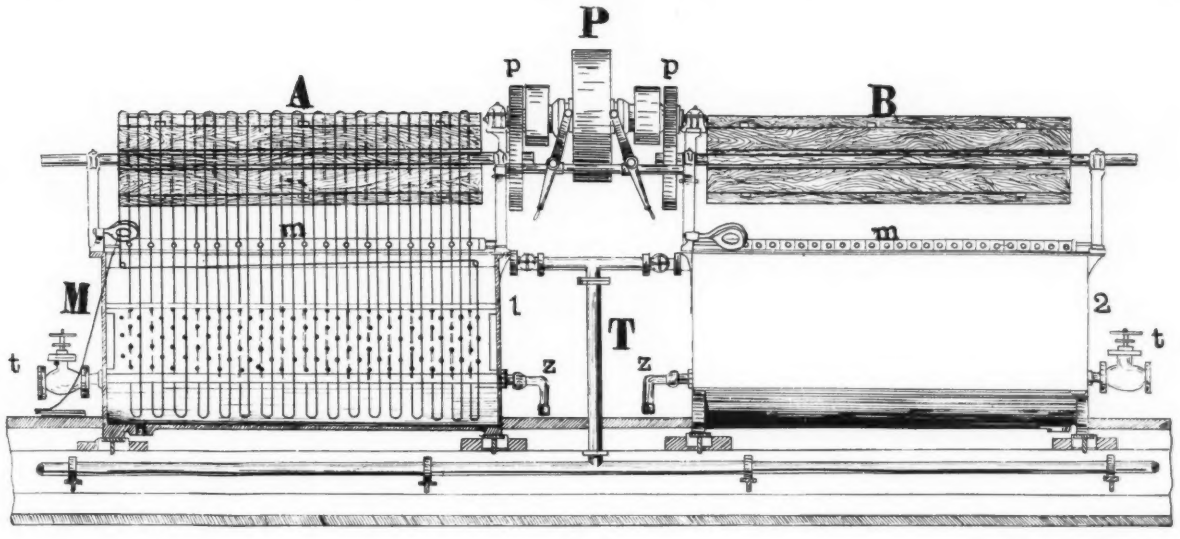

FIG. 1

The one-bath dyeing process can be conducted in three different ways, indicated below:

1. The fabric is first dyed with a substantive black by itself, or with matching colors, for covering the cotton portion, and then treated, in the same bath, with an acid coloring matter mixture for covering the wool.

2. The wool is first dyed with suitable acid coloring matters, that leave untouched the cotton portion, and this is covered over with substantive or direct blacks that dye the wool only slightly.

3. The wool and cotton are dyed simultaneously in one shade with special colors that dye at the same temperature, or at the boil and in the cooling down bath.

In the last case, the vat of the apparatus destined to the treatment of the cotton and wool goods is supplied with the necessary amount of water (generally twenty-five to fifty times the weight of the goods) and this is warmed to 70 to 80 deg. Cent. The properly dissolved coloring matters are then added to the dye bath, and after this the necessary amount of salt (five to twenty grams of sulphate of soda crystals per liter of bath). The goods are now entered, and as soon as they are well wetted the dye bath is brought to the boil. After about one hour's boiling, if everything has been properly arranged beforehand, both the wool and the cotton should be dyed in the same shade. If this has not yet yet been accomplished, as is often the case with new shades, additions of matching colors are made, and the dyeing operations are continued.

CORRECTING THE SHADES

If during the dyeing the shade is nearly matched, and the wool is just a bit too light, a short further boiling will often put matters right. If the wool is not only too light, but is also of different shade from the cotton, this expedient is of no benefit without further additions of coloring matter. When the wool is too dark the goods can no longer be used for producing the required shade, and it is wisest to use them for the dyeing of dark colors or blacks.

Should this not be posible the whole batch is decolorized in another bath and again dyed. If the wool is all right in shade and the cotton is too light, steam is turned off and the goods are allowed to run further, adding if necessary more cotton dyestuff. If neither the wool or the cotton are equal to the pattern to be matched, the wool is first treated in a boiling bath with or without more coloring matter, and then the cotton is treated by turning off the steam. The matching off of the half-wool goods is conducted after drying special cuttings taken therefrom.

DYEINGS FAST TO MILLING

With the above process the shades obtained are not very fast. For obtaining them fast to milling and washing they are aftertreated between 40 and 50 deg. Cent. for one-half hour with a bath containing three kilos of 30 per cent formaldehyde and two kilos of acetic acid at 6 deg. Be. (30 per cent) per 100 kilos of material; or between 50 and 60 deg. Cent. with one and a half kilos of sulphate of copper, one and a half kilos of bichromate of potash and three kilos of 30 per cent acetic acid.

THE TWO-BATH PROCESS

This process is the older of the two, and still finds to-day a certain application even in the most modernly equipped and operated concerns. It is of value when the half-wool goods contain little cotton, and when a strong fastness to washing is not required. In all cases

shades of greater fastness to light than with the one-bath process are obtained. The process can be conducted either by dyeing first the wool in acid coloring matters, washing and covering the cotton with direct colors, or by dyeing first the cotton with a direct black fast to boiling acid baths, and then the wool in an acid bath with a suitable color.

With the first process the half-wool piece goods are dyed in a boiling bath containing, generally, the acid coloring matter, sulphate of soda, and a small quantity of acetic or sulphuric acid. After the dyeing, the cotton in the goods is covered over on the jigger, or through the use of any other suitable machine, in a cold or lukewarm bath, having as little water as possible and containing, besides the direct coloring matter, from ten to thirty grams of sulphate of soda crystals and five grams of calcined carbonate of soda, or from one to two grams of ammonia per liter of dyebath. The sulphate of soda employed should be absolutely neutral, for if acid it would cause a stronger dyeing of the wool than of the cotton, complicating the work of the dyer, and perhaps also causing the production of unsatisfactory shades.

With the process where the cotton is grounded with the direct black, dyeing the wool in a fresh bath with the acid color, the said black has to resist acids, and especially weak mineral acids at the boil. The grounding with the direct black is conducted generally in this case in a not too warm alkaline bath. In this way the coloring of the wool is in great part avoided. For the purpose, the bath, containing about 6 per cent of the direct black, and kept as short as possible of water, is heated from 30 to 50 deg. Cent. To the bath is usually added 20 per cent of sulphate of soda crystals and 3 per cent of calcined carbonate of soda. The piece goods are treated until the cotton in the same has been sufficiently covered. After this they are rinsed thoroughly, and the wool they contain is dyed in a fresh bath containing the acid colors with the addition of 10 per cent of sulphate of soda crystals and from 5 to 10 per cent of sulphuric acid.

In this bath the goods are treated at first at a low temperature, bringing later little by little to the boil. This is conduced for first fixing the direct black completely on the material before conducting the dyeing of the wool, otherwise the wool could be easily overdyed. If conducting the dyeing of other goods the old bath of the direct color is reinforced through the addition of about 4 per cent more dyestuff, 1 per cent more sulphate of soda, and one-half per cent more calcined soda.

The Plant Required

The plant required for the dyeing of cotton and wool fabrics can be varied in accordance if this operation is conducted on the material in rope form, or in full width. In those cases where it is conducted in full width, much highly perfected apparatus is obtainable —indeed, so wide a selection is offered that the manufacturer may well be at a loss to choose which might be of the greatest advantage for the scale on which he wishes to conduct the treatment of the cotton and wool piece goods. A very efficient type of rope dyeing machine is constructed on the principle shown in *Fig.* 1.

This shows two heavy wooden rollers, or winches (A and B), turned simultaneously, or one by one through the assistance of pinion wheels (p, p) and of a central pulley (P), driven from above through a belt The two wooden rollers (A and B) revolve in iron guards placed at a certain height above semi-circular enameled iron vats (1 and 2), fixed in their turn to the floor of the works.

Such vats have towards their bottom on the outside an iron or copper tap (t, t) for leading steam in a closed serpentine in their inside. All excess of condensed water formed in this instance making its way out through an iron tube (z) at the opposite portions of the vats. A large tube (T) serves for leading water through two taps in the one or in the other vat of treatment.

Before and behind the rollers (A and B) is placed a copper guide (m) having a certain number of holes placed at regulated intervals. The wall of each vat (1 and 2) is perforated at its back, and behind the perforations is fixed a narrow entrance case.

A certain number of pieces (M) of half-wool, stitched end to end, are introduced at one end of each vat, and are caused to pass over the winch above this and through the liquor in a spiral manner until the other end of the vat is reached. The first end of the cloth, having been brought over the winch to the front, is passed under a small pulley and led horizontally behind the strands of cloth, under a second pulley situated at the entering end of each vat, there to be stitched to the last end of the pieces and led over the winch again. By this arrangement a long continuous band of cloth is formed which gradually traverses the whole vat in spiral fashion, yet not in a state of tension.

When the first piece has arrived at the end of each winch, it is passed back again over a small roller not shown in the sketch, and over another roller at the other end to where it entered, and is there stitched to the end of the last piece, thus forming an endless band. A plant of ordinary dimensions with two vats is capable of carrying forty and more pieces, owing to the cord of cloth being allowed a certain amount of slack when on the bottom of each vat.

Operation of the Plant in Fig. 1

The working of the above plant requires a good period of practice before all its advantages can be util-

ized to the best advantage, as it is of a certain complication. With it should only be entrusted work people who have assisted for some time to the treatment of the goods without taking an active part. Each lot of half-wool cloth being treated represents in this case a very fair capital, and the responsibility of the workmen is greater than when dyeing on ordinary jiggers. The working of the plant is often conducted as follows: When the colorist has decided on a small scale the recipe to be employed in each case for the dyeing of the cotton and wool cloth goods, the workmen enter these as indicated above, placing in motion both winches or rollers (A and B), and pouring in the dye bath through the perforated portion of the walls of the vats (1 and 2), and turning on steam, at once or after a certain time, in accordance with the process of treatment adopted. In this way the fabric is caused to run continually from the dye bath to the turning roller or winch, and from this again to the dye bath, being colored uniformly all through. When in this way it is thought that the desired shade has been reached, the machine is stopped and a small sample is taken towards one of the places of junction of two pieces. After this the machine can again be started. The small sample is now rinsed, squeezed tightly between the fingers to free it of as much liquid as possible, folded into a clean piece of calico, and dried on one of the steam tubes of the works. After this it is compared with the sample to be matched. From the results of the investigation it is then decided if the batch of cloth being dyed has to be drawn out, if it has to be dyed in the cooling down bath, if it has to be boiled further, if more color has to be added, etc.

If the shade on the different materials in the cloth cannot be determined by the naked eye, the sample is observed under a powerful magnifying glass. In this way the difference in color of the cotton and of the wool portion will be easily seen.

Advantages of Plant

The advantages of the above plant are several, and are of great importance for those works treating large lots of half-wool piece goods. Some of them can be considered as follows:

1. For a given weight of material a given weight of dye bath can be employed, so that if the proportions of the dyestuffs for the production of the shade have been arranged in the laboratory, the cloth can be dyed with these straightway in the works, making, of course, a certain allowance for the different conditions prevailing in each case.

2. The one-bath process can be applied with great success on the above plant, dyeing simultaneously both fibers with short baths at any required temperature.

3. The employment of labor is less than when jiggers are employed.

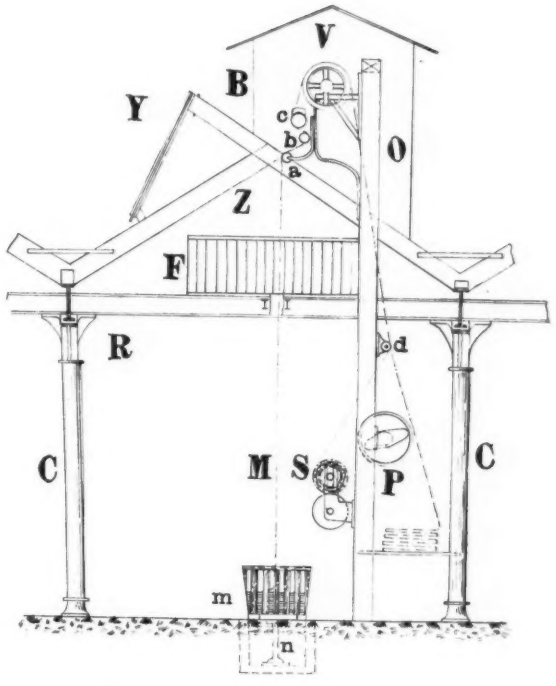

Fig. 2

4. An economy in steam, dyestuffs, sulphate of soda, acid, alkali, space and time is possible owing to the dyeing of several pieces at once.

5. In the dyeing of large lots differences of shade are less frequent than with jigger dyeing.

The Opening Out of the Chains of Cloth

The opening out of the chains of cloth represented, in days gone by, quite a tedious operation, as this had to be conducted by hand by the workmen with great loss of time. Moreover, some difficulty was experienced in freeing the goods of all folds. Nowadays the case is quite different, as there are plants that conduct it automatically very economically and effectively, rendering the task nearly negligible. One of these is constructed on the principle shown in *Fig.* 2.

This is constituted of a special form of shed having four columns, indicated by C, C, supporting an ordinary brick of tile roof (Z), receiving daylight through a long glass window (Y), and higher at one portion, for enclosing a sort of garret (B). Below the lower portion of the roof (Z) are fitted two strong iron rails (R), supporting a special form of guiding frame (F) for containing the cloth to be brought from rope form to full width.

The higher portion of the roof or garret (B) contains three guiding rollers, indicated by a, b and c, and a large wheel (V), all sustained and revolving on the upper portion of a strong iron support (O) that

runs down the whole height of the shed, and is firmly fixed to the cement pavement of the same.

The middle portion of this support contains another small guiding roller (d) through which the cloth can be either rolled on wooden shafts (S), piece after piece, or can be carried on the special plaiting disposition (P) for forming pieces. In order that the rope of cotton and woolen cloth (M) should have the maximum freedom in its movements, it is entered on the plant in a special cage (m) resting on a turning platform (n).

Operation of the Plant in Fig. 2

The working of the above most simple plant offers no special difficulty, nor does it require any extra fatigue on the part of the operatives. These introduce a certain number of pieces at a time in the cage (m), unstitching the end of the last piece entered, and carry the material through the opening frame (F) on the guiding and opening rollers (a, b, c) through the assistance of a cotton or hemp tape, that passes also down on the fourth guiding roller (d). At the beginning the operatives, charged with the working of the plant, have to guide in the cloth from below and above the rails (R). When it has reached the winding shaft (S) or the piece forming device (P), matters are much simplified. As the piece is opened, portions are reached where the chain of cotton and wool cloth has received a certain amount of turning, which would prevent, if left, the formation into full width. This is avoided through the turning of the cage (m).

The operatives change from time to time the roller (S), winding on the spread cloth, if this is used; or take away the piece formed in other cases, unsewing each piece from that following, while another operative sews the end of the last piece being opened to that of the first piece of a new lot to be entered, and that is carried to the plant on a small truck or wagon. Three intelligent operatives are quite sufficient to conduct in this case the opening operations on a very large production of dyed cotton and wool fabrics without these suffering in any way.

(Part VII will appear in an early issue.)

Operations Preliminary to Dyeing Mixtures of Wool and Silk

Outline of Preparatory Treatments—Treatments for Wool and Worsted—Steaming—Scouring—Bleaching —The Peroxide Bleach—Characteristics of Wool and Silk

By GEORGE EMMONS

SILK and wool yarns are woven together, and thus a class of piece goods produced which differs from that obtainable by weaving either yarn singly. The dyeing of the mixed product is, however, not an especially easy matter. Therefore, it may be best to enumerate certain principal advantages and disadvantages. Among the advantages may be listed (1) the fact that unscoured raw silk may be used and (2) the fact that the operations designed to improve the silk can in great part be carried out in the piece, thus eliminating difficult handlings of silk hanks by hand work and substituting machine operations. Among the disadvantages may be included the bad effects upon the wool entailed by the boiling soap baths required for the raw silk.

According to Gandswindt, the effect of the wool may be described as a softening and a swelling up. A gelatinous character is acquired which persists during the boiling period. In consequence, the wool tends to felt together. This may be ever so desirable in fabrics consisting altogether of wool, but is not wanted at all in the mixture. It is, accordingly, desirable to substitute, for the ordinary wool yarn, a worsted yarn that is pretty well bleached. This worsted has a reduced tendency to felt, and so is more convenient.

Outline of Preparatory Treatments

The dyeing of wool-silk mixtures will depend largely upon the success with which certain preparatory treatments are carried out. The operations may be enumerated as follows, though the order may be varied somewhat: Gassing, crabbing, steaming, scouring, and bleaching. Steaming may at times be done subsequently to scouring.

Gassing may also be termed singeing. Its purpose is to remove the projecting ends of fibers that are scattered over the surface of the fabric. These may be burnt or singed off in an apparatus especially designed for the purpose.

The purpose of the crabbing operation is to eliminate or reduce to a reasonable minimum the tendency of the wool in the fabric to shrink. Naturally, this is an important matter in a mixture. Crabbing is advantageously accomplished by treating the fabric in water heated beyond the boiling point. This is accomplished

by using a closed kier in which the pressure may be allowed to accumulate. The operation of crabbing results in fixing the fibers both in shape and position. Succeeding operations should not disturb the fiber relatively to these matters. A special machine is employed in the crabbing operation. A typical apparatus will consist of three troughs or becks. These are fitted with winding rollers, squeeze rollers and guide rollers. Then, there will be devices for keeping the fabric spread. First, the fabric is wound on a lower revolving roller immersed in water. A similar treatment is given in the second beck, after the fabric has been permitted to remain a while in the first bath. The third beck contains cold water, through which the fabric passes for the sake of the cooling effect.

The hot water operating upon the individual threads of the tightly wound cloth occasions a stretching, and this in turn tends to produce parallelism. The object sought is to prevent any further twisting or shrinking. It is claimed that repeated crabbing produces an increased luster. The pressure tends to produce hardness and also a watered effect. Where it is desirable to have the goods remain soft and to maintain the watered appearance due to the character of the weaving—in such cases, pressure may not be especially advantageous.

Steaming

The purpose of the steaming operation is to loosen up threads that have been somewhat flattened by the crabbing. They are thus made more responsive to the scouring operation. It may now be seen that there is some reason for the order—crabbing, steaming, scouring—under the generality of conditions. For the purpose of steaming wool-silk fabrics, "the goods are wound, smoothly and free from wrinkles, on perforated and domed hollow iron cylinders, then covered over with packing cloth or jute, dry steam being forced through the material from a steam pipe. The operation and apparatus are very similar to those employed in steaming woolens. Care must be taken to see that the steam is quite dry; otherwise the fatal "water stains" are liable to appear; and the steam must not be admitted at an excessive pressure. After steaming, the goods are preferably unwound and steamed again, being, for this treatment, wound so that the end previously outside is now in the middle, thus insuring uniform treatment. When the operation is over, the goods are left on the roller for some time until thoroughly cool. So says Gandswindt.

Treatments for Wool and Worsted Differ

In the foregoing it is to be understood that worsted yarn is employed. There are cases, however, where the ordinary woolen yarn will be wanted in the mixture instead. Under these circumstances, the procedure preliminary to dyeing will be somewhat different. That is to say, for example, when light fabrics are to be treated we subject them to a longer washing operation with a fatty soap. The wool may felt together a bit. In this case we may have to raise and shear it. Poplins may be mentioned as a class of fabrics where a felted condition will not be wanted. In case we have a heavy fabric in hand, we may put it through a light milling operation, using a milling soap that contains only a small percentage of soda. Preferably we will use a cylinder machine. We should be careful to remove all traces of the soap by washing. Then we dry the goods. If a fabric is to have a luster when finished we steam with more or less pressure next after washing.

Scouring

Scouring is merely another name for boiling off, in so far as the silk is concerned. We deal with the fabric, containing the silk yarn made from silk more or less raw, much as we would do with the same silk in the hank condition. That is to say, we put the fabric through boiling baths based on soap. As the wool may be undesirably affected, we use great care because of the softening. Besides, the fabric itself tends to develop folds, which the dyer has reason to dread. Where such results are to be feared, we may reduce the effects by employing *weak* soap baths. We leave out alkaline soaps and reduce the period of boiling. Moreover, we seek to do as little handling as possible. Soft water is the thing for the boiling-off bath, or, better yet, distilled water. There will be a series of becks, the fabric being carried through at full width. If some folds form they are to be treated by a stenting operation. Soft brushes may be employed at this time, being used to brush over and obliterate any fold marks, etc. The goods are not to be actually boiled, 80 deg. Cent. (176 deg. Fahr.) being considered hot enough. When the boiling-off is completed, we rinse the goods in warm water, and then with cold.

It is understood that Steinbeck advises the use of hydrochloric acid and sodium phosphate. These are to be used as a substitute, or partial substitute, for the usual soap. Gandswindt appears to think that some soap will be required. Jiggers are employed when the acid and the phosphate are to be used. The first jigger will contain water that has been acidulated by the addition of three-tenths of 1 per cent of its weight of hydrochloric acid. The acidulated water is heated to 60 deg. Cent. (140 deg. Fahr.) and the goods entered. Then, with the fabric kept moving, the temperature is pushed on up to the boiling point. When this temperature level is reached, we add sodium phosphate in an amount equal to twice that of the hydrochloric acid. After this addition, the boiling is continued for two or three hours.

Afterwards the goods are treated in a weak soap

bath, and this is followed by rinsing. If the goods are loosely woven, steam may be employed for the scouring. First, a treatment in one of the jiggers is given for which a 5 per cent solution of soap is employed. This treatment continues for thirty or forty-five minutes at a temperature of 60 to 70 deg. Cent. (140 to 158 deg. Fahr.). Next, the goods are wound on a steam cylinder having a jacket and given a steaming treatment. The steam passes from within outwards. The effect is to remove the best soap. The soap may be collected at the steam outlet valve belonging to the cylinder. After the lapse of one or two hours, there may be no further amounts of bast soap. In such case we continue the steaming for a short period, and then brighten the fabric with 2 per cent of acetic acid. This acid is to be introduced through a funnel arranged at one side of the apparatus. A partial drying may be accomplished in the steam cylinder by admitting warm air. When the wool-silk fabric has been scoured in the foregoing way, it will be ready for the dyeing operation. However, the method is not applicable to all fabrics—only to those of a loose character: poplins, bengalines, etc. It is not to be used on such closely woven fabrics as gloria.

Unless steam is itself employed for the scouring, a brief steaming should follow this operation.

Bleaching

It is perhaps more or less fortunate that wool and silk are both animal fibers, and in consequence lend themselves to bleaching treatments based on the same bleaching agents. That is to say, we may use either the sulphur method, the sulphurous acid procedure or the processes based on hydrogen peroxide. Prior to the bleaching, however, we seek to make sure that all soap has been removed. Long-drawn-out bleaching operations are to be avoided; and also high temperatures. An excess of alkali is likewise to be avoided. If these cautions are disregarded, we may have to pay for our neglect in having the wool-silk fabric dulled in appearance or weakened in tensile strength. "It is also necessary," says Gandswindt, "that the material should not be plunged too violently into the bleach liquor, or, on the other hand, insufficiently immersed."

It seems that it is permissible to make one or more combinations of bleaching processes. Thus we may begin with the sulphur process and follow this by a bleaching treatment based on the action of hydrogen peroxide. This conjunction of methods has proved satisfactory. It seems that the bleaching was well done, and that the strength of the fabric was not impaired. Steaming may also be advantageously combined with bleaching.

It may be as well to state here that the sulphur process of bleaching depends upon the use of the fumes from burning sulphur, and that aqueous sulphurous acid is employed in the other somewhat similar procedure. Whether we use the gas method or the aqueous one, we are to follow the operation promptly with a rinsing in warm water. The action of sulphurous acid is understood to be such that the acid combines with the coloring matter natural to the silk to form a soluble but unstable leuco compound. This should be gotten rid of at once, and rinsing is perhaps the best and quickest process. Otherwise the sulphite compound left in the silk may be expected to decompose. This decomposition may be brought about by the action of carbon dioxide present in ordinary atmospheric air. This may be a slow action. Or there may be rapid decomposition, due to contact with more energetic acids contained in baths to which the fabric is yet to be exposed. The decomposition may be expected to effect a more or less perfect reconstruction of the original coloring matter. In short, unless silk that has been bleached with aqueous sulphurous acid be at once treated with a rinsing, preferably in soft water, we may expect a return of the colored effect to begin. How far such a return will go depends, it would seem, largely upon the amount of residual acid left in the fiber by poor rinsing.

The Peroxide Bleach

The peroxide bleach may be given in more than one way. Thus we may use commercial hydrogen peroxide itself. This is a very convenient method, as there is not much to do. On the other hand, we may use sodium peroxide as the bleaching chemical. However, the bath of plain water is first to be acidulated with the proper amount of sulphuric acid, and the sodium peroxide—in the form of a powder—sifted over the bath, only a little being added at a time. In this way we avoid trouble due to any violent action of the sodium peroxide. Although it is sodium peroxide that is put into the bath, it is understood that it is hydrogen peroxide that actually does the bleaching. The hydrogen peroxide is formed in the bath, and is perhaps a better bleaching agent because it acts while in the nascent state.

Whether we use hydrogen peroxide directly or sodium peroxide, it will be well to use only a wooden, a stone or an enameled vessel, or one made of material not subject to acid action. Where hydrogen peroxide itself is put into the bath, we take care to see that the bath is alkaline by adding enough ammonia or water glass to get a slightly alkaline reaction. To get the best results, it is recommended to begin with a tepid and gradually increase the heat to the boiling point. However, we must remember the wool, and so avoid the high temperatures.

Characteristics of Wool and Silk

Wool and silk are both animal fibers, and therefore more or less alike. Consequently they behave simi-

(*Concluded on page* 363.)

Proceedings of the American Association of Textile Chemists and Colorists

The American Association of Textile Chemists and Colorists

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FIFTEENTH COUNCIL MEETING

The Fifteenth Council Meeting of the American Association of Textile Chemists and Colorists was held April 13, 1923, at the Engineers' Club, Boston, Mass. The following members were in attendance: Prof. L. A. Olney, William D. Livermore, William H. Cady, A. E. Hirst, W. C. Durfee, George A. Moran, Hugh Christison, P. J. Wood, William R. Moorhouse and Dr. W. M. Scott.

The following applicants were admitted for membership in the Association:

Active Membership

Browne, N. B., Kuttroff Pickhardt & Co., 128 Duane Street, New York City.
Textile Chemist and Demonstrator.

Bryant, G. O., Seydel Chemical Company, 120 Broadway, New York City.
Selling and Demonstrating.

Davagne, P., 659 Bloomfield Avenue, Nutley, N. J.
Textile Chemist, Apponaug Company.

Davis, G. H., 176 Herkimer Street, Brooklyn, N. Y.
Dyestuff Tester, U. S. Appraiser's Laboratory, Customs Division.

Ewing, C. R., Box 21, North Dighton, Mass.
Dyer, Mount Hope Finishing Company.

Farron, J., Jr., Lorraine Manufacturing Company, Pawtucket, R. I.
Chemist.

Fidler, J. W., 1243 Church Street, Reading, Pa.
Dyer, Taubel-Scott-Kitzmiller Company, Inc.

Fitzgerald, J. F., 13 Wade Street, Woburn, Mass.
Dyer, Boston Dye House.

Foye, G. A., Box 111, Indian Orchard, Mass.
Dyer, Indian Orchard Company.

Holton, J. H., York Mfg. Company, Saco, Me.
Chemical Engineer.

Kerr, O. W., Oxford Dye Works, 1410 East Oxford Street, Philadelphia, Pa.
Dyer.

Meyer, Dr. Hans, Kuttroff Pickhardt & Co., 128 Duane Street, New York City.
Textile Chemist.

Photis, Christos, 414 Market Street, Lowell, Mass.
Dyer, Hamilton Manufacturing Company.

Richardson, G. O., 14 Canton Road, Shanghai, China.
Textile Chemist, National Aniline & Chemical Co.

Sheehan, H. J., 821 Beacon Street (Suite 45), Boston, Mass.
Demonstrator and Salesman, John Campbell & Co.

Templeton, G. E., Box 365, Simcoe, Ont.
Superintendent, Brook Woolen Company.

Junior Membership

Aronowsky, H., 146 Lefferts Place, Brooklyn, N. Y.
Dyer, U. S. Appraiser's Stores.

Foote, L. R., 185 Cottage Street, Pawtucket, R. I.
Textile Chemist, Lorraine Manufacturing Co.

Schaller, W. A., 36 Woodland Street, Saylesville, R. I.
Dyer, Sayles Finishing Plants.

Van Koert, Leo., 86 Fort Greene Place, Brooklyn, N. Y.
Dyestuff Chemist, Tinc Tura Laboratories.

Walsh, J. B., 1489 Westminster Street, Providence, R. I.
Assistant Chemist, Riverside Mills.

The Council received an application for Corporate Membership from the Nyanza Color & Chemical Company, and same was favorably acted upon.

Considerable time was spent in going over the final form for subjects relative to the prizes which it is the intention of the Council to offer. These subjects are published elsewhere in this issue of the Proceedings, and it is the intention also to publish them in the coming Year Book.

The matter of co-operating with the Bureau of Standards in regard to the matter of standard tests was taken up, and it was voted that the President be appointed to confer with the Bureau of Standards in regard to this matter and report back to the Council at some future time.

The matter of the advisability of having sections of less than twenty-five members was discussed. In view of the fact that in the South there were apparently a number of members who would like to meet together at times but were not sufficient in number to form a section, it seemed to be the general opinion of the Council that such a small section might be organized as a sub-division of the nearest regular section, or that possibly there were a sufficient number of members in the whole South to form a Southern section, which might meet at any point they saw fit so as to accommodate this special group. Dr. Killheffer was appointed to look up the matter of the total number of members in the South and report at the next meeting, so that more definite action could be taken.

W. E. HADLEY, Secretary.

FOURTEENTH RESEARCH COMMITTEE MEETING

The Fourteenth Research Committee Meeting was held April 13, 1923, at the Engineers' Club, Boston, Mass., the following members being present: Prof. L. A. Olney, William D. Livermore, William H. Cady, A. E. Hirst, W. C. Durfee, G. A. Moran, Hugh Christison, P. J. Wood, W. R. Moorhouse, Dr. W. M. Scott, Dr. E. H. Killheffer and W. J. Murray.

Mr. Christison presented a preliminary report of the progress made in regard to the Fastness of Dyed Materials to Perspiration, and Mr. Cady also presented a preliminary report on the Fastness to Light. A letter relative to fastness was read from J. P. Colonel, discussed, and referred to the committee for further consideration.

There was considerable discussion as to the matter of sending samples to the different ones who had fading lights of various types, and the methods which should be followed in order that comparable results might be obtained.

Mr. Livermore, Chairman of the Committee on Fastness to Washing and Fulling of Wool, made a report in regard to the advisability of adding to the standard methods for washing and fulling, investigation as to specific apparatus to be used in making this test. It was the opinion of Mr. Livermore and others that this was not advisable until a more complete investigation could be made, and it was voted that a statement to this effect and an explanation be appended to the Provisional Methods as published in the Year Book.

W. E. HADLEY, Secretary.

CHANGES IN ADDRESSES OF MEMBERS

The following changes in addresses of members should be noted:

Brubaker, Carl H., 47 High Street, Passaic, N. J.

Butler, William H., 115 Mount Vernon Street, Lowell, Mass.

Jaegers, Jr., Robert W., 20 Oakwood Street, Mattapan, Mass.

Ryan, Lawrence F., 81 Marion Street, Somerville, Mass.

Sargents, Robert E., 21 Keeley Street, Haverhill, Mass.

Schoedler, U., Dr., 110 East Forty-second Street, New York City.

Sturtevant, H. B., Waltham Bleachery & Dye Works, Waltham, Mass.

ASSOCIATION PRIZES

(*Competition for the prizes is open and not confined to members.*)

The questionnaire sent out to each member of the Association asking for suggestions as to subjects for prize problems resulted in approximately one hundred

replies. Many of these were similar, and in some instances as many as seven or eight could be grouped as covering the same field.

The Council, at their meeting held March 9, went over these suggested subjects with considerable care, and found that most of them might well be classified under three headings, namely:

A—Research Problems.
B—Improvements of Processes or Developments of New Processes.
C—Special Compilations.

Class A would include such problems as could not be satisfactorily answered or worked out without more or less extended laboratory work or investigation.

Subjects coming under Class B would also require laboratory work and investigation, but it was thought well to definitely classify those which referred particularly to the improvement and development of processes.

Class C would include subjects not requiring laboratory work, but which would consist largely in securing information already in existence in regard to specific subjects and its compilation into proper form to be useful to the members.

From the subjects suggested the following have been selected for competition during the year 1923:

A—Research Problems:

1. Best discussion of various applications of physical chemical methods which have been or might be used in the field of textile chemistry and the application of dyes. (This subject might well include considerable detail as to effect of the decrease or increase of hydrogen ions in the application of dyes and methods of determining hydrogen ions in dye baths.)

2. Practical method of measuring quantity and intensity of sunlight during any given period of time.

3. Methods which will minimize loss of tensile strength when aniline black is dyed on cotton piece goods.

4. A practical and reasonably accurate method for evaluation of diastatic compounds (Diastafor, Polyzime, etc.) for the purpose of desizing textiles.

5. A study of methods for increasing the fastness to light of any class of dyes.

6. Determination of the true nature, particularly colloidal nature, of reduced solutions of vat dyes, and its bearing on their penetration into the fiber. (A study of these solutions from the point of view of pure physical chemistry might lead to results and methods which would enable dyers to get far better penetration than at present.)

7. What is the constitution of the most stable silicophosphate of tin, and what conditions are the most suitable for its production on the silk fiber in the silk-weighting process?

8. A satisfactory method of general industrial value and application for the sectioning of fabrics, yarns and fibers, for microscopic purposes.

B—Improvement of Processes or Development of New Processes:

1. Method for Padding Vat Colors on Cotton Cloth which shall be an improvement over existing methods.

2. Method of satisfactorily applying aniline black to cotton in a circulating machine.

3. A satisfactory process for mordanting wool with chromium compounds which will consume materially less time than methods in use at present.

4. A method of carbonizing cloth which will be an improvement over those in use at the present time.

C—Special Compilations:

1. Most complete Bibliography of Books and Pamphlets on Textile Chemistry and the Application of Dyes.

RULES GOVERNING THE AWARD OF PRIZES

For the year 1923 the Council has established the following rules as governing the awarding of prizes:

1. All manuscripts, drawings and illustrative exhibits must be in the hands of the Secretary by December 31, 1923.

2. All manuscripts should be signed by a nom de plume, and the correct name of the competitor placed in a sealed envelope bearing upon the outside the nom de plume. This envelope should be attached to the presented manuscript, and will be held by the Secretary and not opened until the Council shall so authorize.

3. Whenever a competitor presents to the Secretary such a manuscript, a committee of three, consisting of the President and the two Vice-Presidents, shall appoint a special committee of three members of the

Association whom they believe well qualified to examine the manuscript and communicate to the Council at as early a date as possible its findings in regard to its merit. When all such reports are in, the Council will consider them as a whole and make such awards as they deem just and advisable.

4. For the year 1923 one hundred dollars will be available for these awards, and the Council has deemed it advisable not to specify any special amount for each subject but to remain free to award larger or smaller sums as each case may, in their opinion, merit. The minimum prize to be awarded will be twenty dollars.

While December 31 is set as the last date upon which competitive material will be received, it is advisable to present such material to the Secretary as early as possible.

The above rules have been established by the Council merely for the year 1923, and they may be modified or changed for future years as the result of the experience of their operation.

SPECIAL PRIZES

If any person elects to submit to the Council a paper upon any subject related to Textile Chemistry not included in the above which, in the opinion of the Council, has special merit, a prize may be awarded for it.

Special prizes may also be offered for special subjects by approval of the Council, and notice of such prizes and subjects will be published in the Proceedings.

Special Prize No. 1.—A special prize of twenty-five dollars has been offered by P. J. Wood, Chairman of the New York Section, for a satisfactory solution of the following problem: "A Method of Applying Basic Colors to Textiles so that the Colored Material will be Fast to Rubbing."

APRIL MEETING OF THE NEW YORK SECTION

The regular monthly meeting of the New York Section of the American Association of Textile Chemists and Colorists was held Friday evening, April 27, at Stewart's Restaurant, 30 Park Place, New York City.

After an excellent dinner the meeting was called to order by Chairman Wood and the minutes of the last meeting and the Treasurer's report were read and accepted.

It was pointed out by the chairman that the meeting to be held May 25 would be the last of the current season and that the by-laws provided that at this time election of officers for the succeeding year should be held. After some discussion it was decided to appoint a nominating committee who should present two or more candidates for each office. This committee as appointed consisted of W. E. Mitchell, chairman, and Messrs Daniel P. Knowland, Joseph S. Lange, and Henry F. Herrmann.

The question of the site of the May meeting was discussed at some length, and it was eventually decided that it be held at the Newark Athletic Club, Newark, N. J.

At the conclusion of the business meeting the chairman introduced Harry Clapham, dyer at the Passaic Worsted Spinning Company, who spoke on the subject, "Some Dyeing Machines I Have Seen and Used, with Special Reference to Dyeing Wool Tops." Mr. Clapham's paper follows:

"Some Dyeing Machines I Have Seen and Used, with Special Reference to Dyeing Wool Tops"

By Harry Clapham

Mr. Chairman and Gentlemen—My coming here to-night is not to start a controversy in regard to the values of certain machines so much as to give my experience with machines, and especially one final type of machine. I do not wish any remark which I make to-night to be misconstrued. I am not here to say that any type of dyeing machine will not do the work for which the makers claim that it is fitted. I leave that to the experience of each individual textile colorist and his experience of the machine he has handled. At the close of the paper, no doubt some members will be able to give experiences of their own in an informal way for the benefit of those present. My lecture was announced to deal chiefly with top dyeing, but in my remarks I shall mention the other forms of machinery, such as machinery for dyeing loose materials and skeins and cheeses.

In the remarks on the final machine, I wish to say that I do not claim that it is absolutely perfect, but I am satisfied that it is much nearer perfection than many machines and methods of past times, so far as my experience goes.

I will divide the lecture into the following heads: Machines for dyeing loose materials, machines for dyeing wool tops, machines for dyeing cheeses and skeins.

I know that each of these processes and machines would take a whole evening to do justice to it, so my remarks will necessarily have to be somewhat brief and any point of interest which strikes my hearers will be answered to the best of my ability during the discussion which follows.

Dyeing of Loose Materials

Originally the dyeing of loose materials was done in an open pan over a fire, and I have seen several of these pans, only with the fire replaced by steam for heating; but still the material is moved by means of long poles. In connection with this, I may say that I used to dye *Indigo on wool* by this method and got a better and cleaner result than I did when I put the material into a machine and pumped the reduced dye liquor through it. The only difference was, I could do about six times more work in the machine. This was due to faults in this particular type machine which were difficult to overcome and keep in order. The dyeing of loose materials in machines offers so many advantages that sooner or later the hand method will disappear. The two things concerned in the dyeing operation are the material to be dyed, and the dye liquor. In hand dyeing, and in one or two forms of machine dyeing, the material is made to move through the liquor. In most forms of machine dyeing the material is stationary and the liquors are made to move through it, and this, to my mind, is the most rational method and prevents any possibility of felting and rolling, or breaking. Other advantages of machine dyeing are evenness of shade, saving in labor and steam, and larger output. There are many machines on the market for dyeing loose materials. They may be divided into two classes—machines in which the liquor passes through the material by its own weight, and machines in which the circulation of the liquor is obtained by the force of a pump. The first ones work on the gravitation principle. In these machines the liquor is lifted by means of force of steam or pump and spread over the material. I used one of these machines for dyeing loose wool and in another case I used a similar machine for bleaching knitted fabrics of cotton and artificial silk, and open woven cotton materials, and I found I could get good results provided the machine was packed very evenly. If, on the other hand, there was the least unevenness in packing, channeling occurred with consequent trouble; also it took a large amount of water to wash the material. In the case of the machines where the liquor was forced through the material by means of a pump, I have seen and worked several different makes of machines. In these machines the differences are chiefly in the design of the container in which the material is packed. The first machine I worked consisted of a square tank with a perforated false bottom and a perforated top. The next machine was a cone shaped perforated floor and a circular perforated top. The third type of machine was a circular drum with a perforated feed pipe in the center.

Another machine had an oblong box with a grating in the bottom and a grating to fit on the top, and the liquor was forced to flow in two directions by means of paddles at the back of the machine. In all these machines, I could get good results by very careful packing and attention to detail.

In the machine I am finally going to describe, the Callebaut & De Blicquy machine (*Fig.* 1), there is a cage shaped like a large round drum of more than six feet diameter; a hole is provided at the bottom of same for the entrance of the liquor. At a certain distance above this hole is a false perforated bottom, and at the top of the drum or cage is a cover which is also perforated, and which is fastened and held by movable screws and nuts. This cage is put into a round tank, which is connected by pipes to the centrifugal pump.

This machine insures a good level dyeing for the reason that the dye liquor, pressed by the force of the pump, attacks the material on a very large surface, namely, all the surface of the false perforated bottom of the cage (nearly thirty square feet), and also because the layer of material through which the dye liquor has to pass is not thick (22 to 26 inches), thus allowing rapid circulation of the liquor, which avoids unequal exhaustion of the dye.

Another important fact which favors good dyeing is the conical shape of the cage. Owing to this shape, the material placed in the cage becomes a conical mass, which, being pressed from below towards the upper and narrower part of the pan, automatically closes all openings or channels that otherwise would be liable to form, and through which the liquor would flow and cause uneven dyeing. The levelness is further assured by the fact that the diameter of the cage, being larger at the bottom, where the dye liquor enters, than at the top, where it flows out of the cage, comes in contact with the largest quantity of material when it has its full strength, and less material as it gets weaker, thus answering the principles of good dyeing.

An interesting fact which is worth mentioning is that I have never had any trouble with white spots in the dyed material (caused by air bubbles), and I believe this is owing to the conical shape. Without doubt, the air is squeezed out when the material is pressed from below towards the narrower part of the cone, by the force of the pump.

The saving in labor is insured by the fact that the *loading* of the cage is very easy, because the material has not to be packed hard to avoid channeling, but may be

put gently into the open cage, which offers a suitable capacity. To facilitate the *unloading* of the material, it has a special frame wherein the conical cage can be placed, and then tilted, so that the material can be quickly removed into trucks prepared for the purpose.

This machine saves steam, as practice has proved that at least three batches can be dyed in the same quantity of water which would be required to dye one batch in an open pan, or in open machines with propellers in which the material is floating in the liquor. In fact, the amount of liquor is one to eight for cotton and one to ten for wool.

This machine has a big production, because it is built with a movable cage, allowing loading and unloading outside the machine, and so one batch can be loaded while another is dyeing. It will dye from 450 to 600 pounds of cotton, or from 450 to 700 pounds of wool, according to the quality of material.

The dyeing is performed as usual, the liquor circulating all the time from bottom to top through the material; however, once or twice during the dyeing the liquor is sucked out of the material by way of the special device which is placed between the pump and the tank, and the result is that the material having been disturbed from its former position, lets the liquor flow through different ways than previously, when the circulation is again resumed, thus improving the levelness of dyeing.

When the dyeing operation is finished, the liquor is sent to a reserve tank by way of the same device, and everything is done by the use of one handle, and not only do we aspirate the liquor which is in the tank but we also perform a sucking action on the material itself so that all the excess liquor in same is drained out and sent to the reserve tank. It is easy to understand that this prepares the goods for a quick and thorough washing off.

Top Dyeing

In speaking of the dyeing of combed worsted sliver in the form universally known as tops, it is very susceptible to damage by careless or rough handling, and the relative fragility increases the difficulty of successfully dyeing the material. The first machine I worked on for dyeing wool in sliver form, the tops had to be unwound and reeled into big skeins and were dyed in this form. (I know of and have seen places where this is still done and the skeins are dyed over sticks by hand.) But on this machine, the sliver skeins were put onto a circular

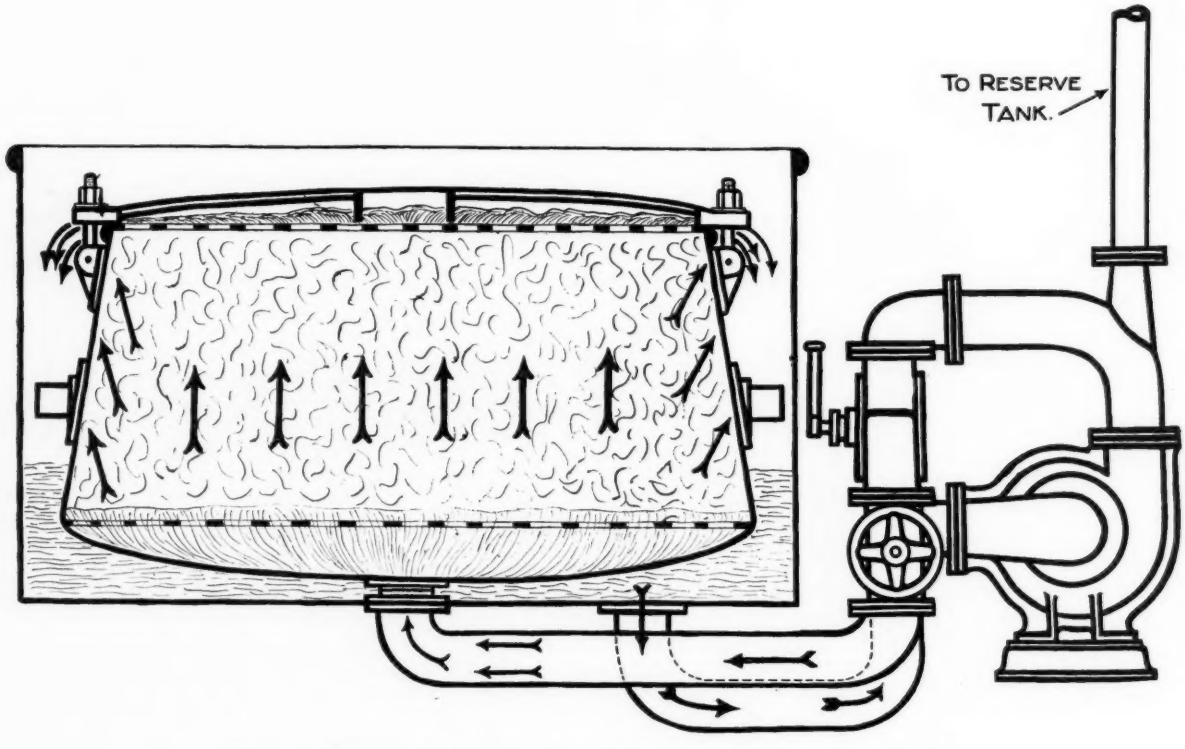

Fig. 1—*Callebaut & De Blicquy Machine for Dyeing Loose Materials*

wheel, namely, the Klauder Weldon type. Then I also dyed them on the Hussong machine by hanging them over sticks. In these machines and in hand dyeing care had to be used to avoid felting, and the proportion of liquor used was much more than when dyeing in the ball form. Another advantage of dyeing in the top instead of hank form, that is, the tops can be taken straightaway to a back washing machine for drying, thus eliminating the reeling process. The tops are successively dried, gilled and reballed on that machine. It is therefore quite clear that a big saving in labor is realized. Another feature is that there is practically no waste. The first top dyeing machine that I used to dye actually in the ball consisted of a square tank with a perforated false bottom and perforated top, the same machine used for loose material. Then I used the machine with the cone-shaped false bottom mentioned in loose wool dyeing. The next type of machine consisted of cylinders into which the tops were placed and these were lifted into a tank by means of a crane and fitted horizontally with a center compartment for the liquor to flow in and out through the tops. The next machine was made by having a central chamber for the dye liquor to enter and the cans were riveted horizontally to it. In another machine I placed the tops onto perforated spindles and fixed them by means of a lid. In the machines I described and in which loose materials were dyed when I came to dye tops in them, I found that the uneven resistance caused by the round shape of the balls, when packed together instead of being placed in separate cans, often gave rise to bad circulation of the liquor with consequent irregular dyeing, and the tops came out of these machines in all kinds of shapes, unless very great care was exercised. In the can-machines mentioned in each case, the cans, during dyeing, were in a horizontal position, and in dyeing with chrome colors I found that in many cases the wool shrank in chroming and washing off and then left a space at the top through which the dye liquor found its way and did not go through the top at all. To remedy this, the tops had to be made oversize, which created trouble and loss of time in packing. Also the washing off was bad in many cases. These machines were also made of copper, and as most of you know many colors are sensitive to metal. In these machines I had to lift the cans out of the machine, which means labor. With the spindle machine, which I worked, I found several things:

First—Having only one way flow of liquor on this machine, namely, from the inside to the out, the strong dye liquor met the least quantity of wool when at its strongest and thus if care was not taken, the inside was dyed darker than the out, giving trouble in matching and requiring more gilling to get the first resultant shade. Also, the outside of the tops were always more or less matted, as the wool was freer to float about. I will now describe a machine on which I got good results for top dyeing, namely, the Callebaut & De Blicquy machine

In the Callebaut & De Blicquy top-dyeing machines the cans are in a vertical position, wherein the tops, if they shrink by cold washing off, can never leave an open space to allow the liquor to run away, as by the pressure of the pump they are lifted up from the bottom to the top of the can and pressed against the top perforated lid, in the manner indicated in *Fig.* 2. Even if the tops fall down upon the bottom of the can when the pump is stopped, they are again lifted up as soon as the pump is started. In these machines the trouble of having the tops stained by the contact of the copper can is avoided, as same are made of a special hard cast iron and covered with "Vitralite" inside and out, the use of which has been patented. This product is as smooth as glass, does not affect the colored material, is not attacked by acids, and always remains clean.

Several years of daily use has proved that the "Vitralite" material withstands a severe test, and machines working for six years do not show any depreciation.

The vertical cans being fixed in the bottom of the machine, they have never to be taken out, and no crane is wanted. The loading of the tops is done easily and quickly, and the unloading is performed by the pump itself, which, when the cover plates are removed, forces the tops out of the can, and they then have simply to be taken away, instead of having to be pulled out by hand.

Another improvement in the C. D. B. machine is that the circulation of the dye liquor can be performed in two ways, a fact which is impossible on the horizontal-can machines. This means that the dye liquor can go through the material once from the bottom to the top, and then from top to bottom. This double circulation is obtained simply by reversing the lever of a special device placed between the tank and the pump, and which acts independently of the latter, as the pump always runs in the same direction. For the dyeing of different classes of wool, it is possible to vary the speed of the pump by means of a stepped pulley so as to have the exact pressure desired, and no more. If specially requested, these machines can also be made in such a way that it is possible to cut off some of the cans and so work with a smaller number than the machine was intended for. All colors can be dyed in these top-dyeing machines, provided of course, that they are soluble in water, which

is a matter of first importance for all mechanical dyeing machines. Logwood Black, with chroming before dyeing, is very successfully performed, and washing off after chroming can be executed very quickly, as it is possible to suck the chrome liquor out of the tops by a special reversing device. In addition to what has been said, we may add that if for some special reason it is preferred to dye the sliver in the hank form instead of in the ball, these machines can also be used, as the reeled sliver can be put into the "Vitralite" cans without any difficulty. Dyeing thus takes place in the same perfect condition as if in the ball, and without any felting at all. I have dyed yarn in hank form successfully, although this machine is not built for yarn dyeing. These machines are built in sizes from 2, 4, 8, 14, 28, up to 40 cans, and each can contains two tops, a 40-can machine will thus take 80 tops either of Botany or cross-bred. It may be interesting to mention that the "Vitralite" material has been applied to other uses, such as pans to dissolve the dyes, buckets, laboratory beakers and also small dyeing tanks, etc., which have all proved to be very useful.

Cheese Dyeing

I now wish to touch briefly on the dyeing of cheeses. Of these machines, I had experience of dyeing on three classes of machine:

1. One in which the cheeses were put on paper tubes.

2. A machine in which the cheeses were put on a covered spring.

3. The Callebaut & De Blicquy machine, in which the cheeses are first put onto wooden spools and from there straight onto the perforated spindles. In England, cotton yarn was very often dyed in the warp form, which gave very good results. For striped work, cheese dyeing has advantages which are not realized in warp dyeing. Dyed cheeses of standard colors can be kept in stock in any quantities, ready for conversion into warps to any given particulars at short notice. It eliminates all disadvantages of dyeing in the hank, and saves the reeling and winding charges incident to hank dyeing.

The dyeing of weft in cheese form instead of the common practice of dyeing in hanks is of special interest, for the following reasons:

1. When buying yarn in the cop form instead of in hank, there is a difference in the price in favor of the former.

2. Cheeses can be made from the cops at little ex-

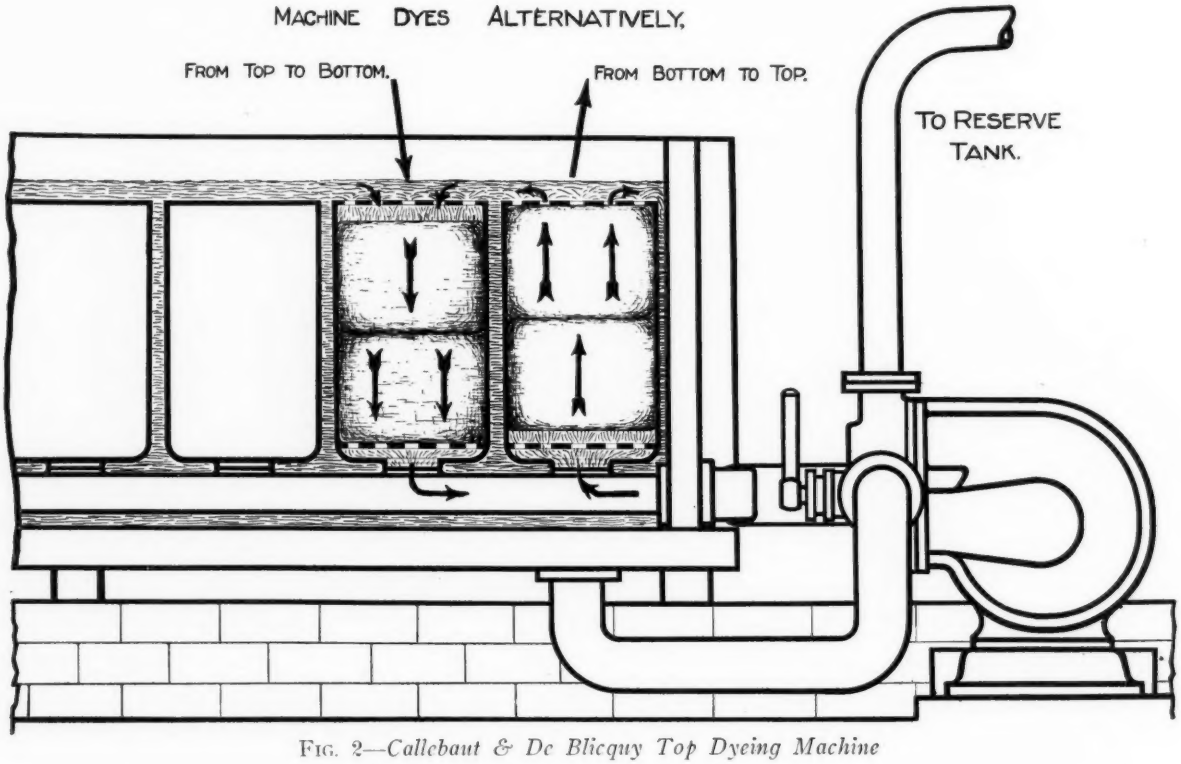

Fig. 2—*Callebaut & De Blicquy Top Dyeing Machine*

pense, and it is possible to dye 480 cheeses at a time, viz., nearly 500 pounds of yarn, instead of 100 pounds when dyed in an open vat.

3. After dyeing, the cheeses can be rewound into cops on a high-speed winding frame, which will put the maximum length of yarn on each cop.

4. The cost of winding such cops from cheeses is only half that of making the same cops from hank, while the production is doubled and waste is greatly reduced.

It may also be mentioned that cheeses form a very suitable source of supply to doubling frames, whereby colored twists can be made by twisting the threads from two or more differently colored cheeses, or grandrelle can be made by twisting the threads from a dyed and an undyed cheese. Recently considerable interest has been evident in the dyeing of wool yarn in cheese form. This allows the spinner to spin always in the white, thus avoiding the cleaning of the carding and spinning machines after every different color, and so saving a good deal of trouble and labor. This method also allows the dyeing of the exact quantity required, and no more, as the wool has not to undergo the whole process of spinning after dyeing.

In order to insure gaining the favor of manufacturers, cheese-dyeing machines must be capable of giving absolutely level and uniform dyeings, and to my mind the C. D. B. machine is thoroughly reliable in this respect, as special care has been taken in the design of the machine to remove the causes of unlevel dyeing. In some machines it is necessary to wind the cheeses on perforated paper tubes, which are afterwards placed over perforated nickeline tubes in the dyeing machine, whence the liquor is circulated by the action of the pump. It is easy to understand that the dye liquor has difficulty in passing through both the perforated tubes without obstruction occurring, because the holes in one tube do not always correspond with the holes in the other tube. More often than not the contrary happens, with the result that about half of the holes are stopped, leaving only half of them open to carry the liquor from the inside nickeline tube to the yarn wound upon the paper tube. This causes inefficient circulation of the liquor and bad dyeing of the cheeses.

A further disadvantage of this system arises from the necessity of the paper tubes having to go into the dye bath, so that they can only be used once, and become a constant source of recurring expense. Another difficulty in these machines with paper tubes is that it is not possible to press the cheeses together, and the edges or flange sides of the cheeses, being less tightened or compressed than the middle, allow the liquor to flow through too easily, so that the yarn shows uneven dyeing, with white spots in some places; also, the wound cheeses not being all of the same hardness, the soft ones pass more liquor than the hardest ones, hence there are differences in the intensity of the shade of individual cheeses.

In the C. D. B. cheese-dyeing machine all the above-mentioned disadvantages are avoided. In the first place, the cheeses are wound upon simple wood bobbins, which are smooth and substantially parallel in shape. The bobbins are cheap and strong and practically indestructible with ordinary usage, and as they never go into the dye bath they can be used over and over again *ad lib.*

The dyeing takes place upon perforated nickeline tubes, which are very slightly smaller in diameter than the wooden bobbins. With the aid of an internal slot which is cut in one end of each bobbin to fit a projection on the end of the dyeing tube, the bobbin is held in alignment with the upper end of a nickeline tube, whence the yarn or cheese is slid downwards from the bobbin onto the tube. In a standard machine each tube holds six cheeses. Then, after dyeing, the process is reversed; each cheese is slipped off the nickeline tube, as shown in *Fig.* 3, onto a separate wooden bobbin, the diameter of which, at the top, is very slightly less than the diameter of the nickeline tube, to facilitate easy transference of the yarn. On these bobbins the cheeses are dried, and thence may be used in the creel of the warping machine; or, in the case of weft, as a source of supply to the cop or pirn winding machine. The makers claim that with ordinary care the yarn may be transferred from the bobbins, entirely without waste.

This method of transferring the cheeses to the dyeing tubes has two outstanding advantages: (1) There is only one perforated tube through which the dye liquor has to pass, instead of two, and the material being in direct contact with this tube, without any paper tube between, it is attacked directly by the dye liquor, giving perfect circulation and uniform dyeing; (2) there is no repeated expense of having to buy paper tubes.

A further advantage which is directly productive of more perfect dyeing arises through compressing the cheeses on the dyeing tubes. After the nickeline tube has been loaded with its complement of six cheeses, the latter are pressed tightly together by a screw on the end of the tube. In this way the edges of the cheeses are as tight as the center, and any differences in the resistance offered by hard and soft cheeses are neutralized by compressing them together on one spindle. The soft cheeses will "give" more easily than the hard cheeses, and so from one uniformly packed cheese or miniature beam. This is a great aid to uniform dyeing, as no channels can form, and all portions of the cheese receive equal treat-

ment. With this method of loading the dyeing tubes, white spots are unknown in the dyed cheeses.

The procedure for dyeing with the C. D. B. machine is as follows: After the nickeline dyeing tubes have been filled with cheeses, their lower ends are fitted into a specially designed frame. The cheeses are then compressed in the manner already described. It should be noted that this process of charging the tubes and loading the tube frame takes place outside the machine, while the latter is dyeing a previous set. The whole frame, with the tubes in position, is then lifted bodily into the dyeing cistern by an overhead crane. By the reversal of a lever of a valve-controlling apparatus, which acts independently of the pump, the circulation of the liquor may flow from the interior of the cheeses to the exterior, or vice versa. In practice the liquor is circulated "inside out" for a prescribed length of time, and then reversed "outside in" for a time. This alternate reversed circulation of the liquor is continued until dyeing is complete.

After the material is dyed, the liquor may either be run away or be pumped into a reserve tank. Then, by simply manipulating the lever, an exhaust action is induced whereby the greater part of the dye liquor is sucked out of the cheeses. This is useful provision because it not only conserves dye liquor which has to be saved, but it reduces the time required for washing to a few minutes, besides saving a considerable amount of water.

The makers claim that the machine is a proved success, and that it offers an economical mode of dyeing yarn in cheese form for any branch of the textile trade where cheeses can be utilized. The dyeings are uniformly level, even in light shades. The machine is made in several sizes, as follows:

No. 1 with 4 tubes, will dye 24 to 28 cheeses.
No. 2 with 10 tubes, will dye 60 to 70 cheeses.
No. 3 with 49 tubes, will dye 240 to 280 cheeses.
No. 4 with 80 tubes, will dye 480 to 560 cheeses.

Roughly, each cheese holds one pound or more of yarn; therefore, the larger machines will dye 500 pounds of yarn at one time. If spare frames are used, and loaded and prepared while the previous bath is being dyed, four batches per day can be dyed.

Yarn Dyeing

The dyeing of yarn in the hank has been performed in open tanks right from the very beginning, and, strange to say, this method of dyeing has not been

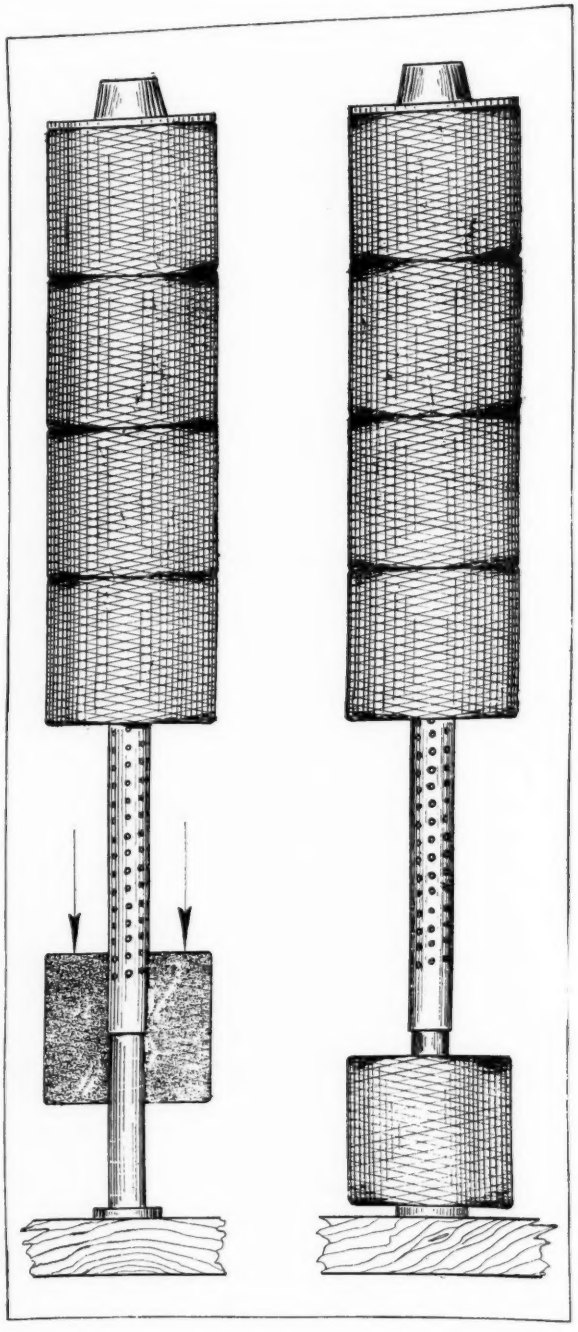

Fig. 3—*Removing Cheeses to Wooden Bobbins from Callebaut & De Bricquy Machine After Dyeing*

improved very much, if at all. In every country the old process of dyeing yarn on sticks which lay across the open tank is still performed despite the invention of machines, and the reason for this is that it has been so difficult to find machines which will always give perfect results. The machines able to dye in hanks can be divided as follows: (1) Machines in which the hanks are packed, and (2) machines in which the hanks hang on sticks.

In the pack machines the hanks are placed in the cage of the machine, just as if they were loose stock. They are placed in several layers one upon the other, and the dye liquor is pressed through the mass of hanks by aid of the pump. There is not the slightest reason why hanks should not be dyed successfully in that way, providing the colors used are soluble and that the pump has the necessary power to force the liquor through the material. However, a great drawback is that the material to be dyed acts as a filter for the dye liquor, and so retains all impurities which are in the dye bath, these impurities settling on the bottom layer of the yarn. It is true that this also occurs when dyeing loose cotton or loose wool, but the difference is that yarn is a finished article and loose material is not, and as the latter has still to be spun after dyeing it does not matter very much if the bottom layer is somewhat soiled. However, it matters very much if a hank of yarn is soiled, as the stains cannot easily be removed. This is why these machines have never given very good results (except for black or other dark shades) and why they have not been used on a large scale. A few of our machines of the conical pan type dye Sulphide Black on cotton hanks, but their use is restricted to black, as we do not recommend the dyeing of other colors.

Among the machines in which hanks hang on sticks we find that we can divide them into machines in which hanks circulate in the dye liquor and machines in which the dye liquor circulates through the hanks.

In the former we find numerous machines in which the dyeing by hand has been imitated but where everything is done mechanically. The hanks are hung on sticks of a special shape and a mechanical device is used for turning the hanks from bottom to top; however, this device is usually very complicated and is liable to give trouble. These machines have chiefly been used in France and Germany, and in a few other Continental countries, but very few have found their way here.

A different idea is the machines in which the hanks of yarn are placed on a large wheel which revolves into the dye liquor, so bringing all the hanks, one after the other, in and out of the dye liquor. A good many of these machines were in use here but have lately been abandoned, as the yarn is so likely to be felted (especially fine *worsted* yarn), and levelness is not always good. However, for cotton hanks the results are better, and one can still find a few of these machines working.

Regarding the machines in which the liquor circulates through the hanks which are hung on sticks, some of them have the hanks fastened top and bottom and others only the top. In the first case the hanks are stretched on small frames, with a stick or rod on the top and another one on the bottom. The frames are then placed in the machine and the dye liquor is forced through the hanks by way of a centrifugal pump. In order to obtain good results on these machines it is necessary for the hanks to be spread open on the sticks or rods very carefully and very evenly so as to obtain an even resistance all over and to prevent the liquor going by preference through certain portions where there is less resistance rather than through other portions where there is more resistance. Thus these machines require a lot of labor, and very skilled labor too; furthermore, the output is very small.

The case is very different with machines in which the hanks are only supported at the top and the bottom is hanging free in the liquor. This is a type of machine which has been in use for a very long time on the Continent for the purpose of bleaching yarn, especially linen yarn, and also for dyeing same. It is this principle which has also been used for the Hussong machines and other ones in America, like the Cyclone machines.

For linen yarns, glass rods are sometimes placed between two rows of hanks in order to prevent the yarn from being entangled, and also in order to regulate the flow of the liquor. However, this is not necessary for dyeing wool hanks successfully. On the contrary, it is required that the whole mass of yarn lifts up gently and as regularly as possible, so as to offer an even resistance to the dye liquor. In this respect these machines are really working on the packing system, but with the advantage that, owing to the yarn hanging on sticks, the pack is not so tight as in the packing machines, and that same is slackened when the liquor is reversed and circulates from top to bottom. The hanks are then straightened out again until the former lifting-up circulation is again resumed, and so alternately through the whole time of dyeing. There is not the slightest doubt that these machines have proved to be efficient and that good results are obtained, provided the machine is well made and that

suitable colors are used. I think it is not necessary to spend much time in explaining how these machines are constructed, as you are all well acquainted with same, but the only points which I should like to explain to you are those where our machines differ from others.

A first and important difference is that we are making our machines much shorter. The dyeing space we have adopted is only 6 feet long, as our experiments have proved that the circulation is the most regular and efficient over this length. However, the width of the machine varies according to the quantities to be dyed, and the number of propellers increases in proportion. Therefore, there are either one, two or three propellers, according to the size of the machine. The result of this increase in the number of propellers is that every propeller, either in the narrower or wider machines, always sends its liquor over the same area. In this way the quantity of dye liquor passing through a given weight of yarn is always constant, and when a batch has been dyed on a small machine the same shade can be reproduced on a larger machine without the least hesitation, knowing that good results will be obtained.

Further, the sides of the tank, instead of being straight, are conical; by doing this we have no space under the frame between the sides of the tank and the yarn, where the liquor runs more freely than in the middle, when the liquor circulates from top to bottom. The yarn is well packed in the narrower portion of the tank, and so offers a more even resistance to the dye liquor.

Another point is that the propellers are strongly fixed on one iron base-plate, and are therefore free from any warping of the tank. They always run true, and this is one of the chief conditions of good working of this type of machines.

The driving of the propellers is done by pulleys, with an open and cross belt, which gives a very smooth running, and when the flow of the liquor is changed from one circulation to the other this does not take place all at once but very gently and steadily, as the circulation is gradually slowed down and gradually starts again in the other way until recovering its former speed; this keeps the yarn in a perfect condition.

A last feature to which I should like to call attention is that the gear wheels are enclosed and lubrication is done in a special way so that no oil or grease can get into the dye liquor and cause stains.

There are some smaller improvements we have made on these machines, especially in the engineering parts, but they are not of the same technical importance to you as to the ones already mentioned.

OPERATIONS PRELIMINARY TO DYEING MIXTURES OF WOOL AND SILK

(*Concluded from page* 350.)

larly with respect to certain influences. At the same time, it is to be noted that while the two fibers have certain things in common they also differ in respect to certain other things. In consequence, we are also to expect certain differences in behavior when subjected to the same treatments.

Wool is to be regarded as somewhat more sensitive to the alkalies than silk. This is to be viewed as a broad general rule, having perhaps some exceptions to it. As to acids, wool is to be considered as less sensitive than silk. This also is a general rule, which may have its exceptions.

With respect to their behavior toward the salts of metals, especially the basic salts of the heavy metals, the two fibers are much alike. Both dissociate such salts. Both fibers absorb the metallic hydroxide. Perhaps they also absorb a salt of even higher basicity. So far the two fibers act alike. However, certain differences are to be noted. Silk fiber is competent to decompose many of the salts referred to under circumstances where the temperature is rated as either cold or only moderately warm. Wool seems, on the whole, to require higher temperatures in order to produce the same results. Protracted boiling may even be necessary in the case of wool.

Gandswindt regards the foregoing differences between wool and silk as of minor importance, and such as to have practically no adverse influence upon the dyeing which takes place later on. He thinks that a more significant difference is that which relates to their behavior with respect to the dyestuffs themselves. In short, it appears that, in dealing with wool-silk fabrics, more severe attention will have to be paid to the effects in connection with the dyes than to the effecs in connection with the auxiliary chemicals. At the same time, it will be well to bear in mind the differences connected with their behavior toward alkalies and acids and the differences in temperature to be associated with the decomposition of metallic salts.—Silk.

Dyes, Dyers and Dyeing Fifty Years Ago

Aniline Dyes—Boilers and Steam Pressures—An Explosion—Power Winches—Coal Prices—Water Supplies —Secrets and Jealousies—Highway Robberies—A Ten-Shilling Chimney—The Fletcher Trial—Droll Characters—Oates Ingham

By J. W. EASTBURN

A Paper Read Before the Halifax Branch, Foremen Dyers' Guild. Copyright of the Guild.

(Note—We believe that not even the busiest colorist can fail to be entertained by this humorous and vivid account of doings in the British trade a half-century ago.—Ed.)

I WILL give you a list of the dye wares used at the Greenmount Dye Works, Halifax, in 1870 and a little later:

Cochineal	Cream of tartar
Cochineal (ammoniacal)	Red prussiate of potash
Paste grain	Yellow prussiate of potash
Legs and wings	Bichromate of potash
Lac dye	Nitric acid
Flavine	Muriatic acid
Cudbear and archil	Sulphuric acid
Madder	Nitrate of tin
Logwood	Nitro muriate of tin
Fustic	Muriate of tin
Fustic extract	Sulpho muriate of tin
Indigo	Blue spirits (royal)
Indigo extract	Grain bar tin
Barwood	Feathered tin
Camwood	Alum
Magenta acetate	Glauber salt
Magenta crystals	Oxalic acid
Picric acid paste	Ammonia
Picric acid crystals	Alkaline blue (spirit)
	Alkaline blue (water)

Legs and wings were the waste of cochineal. The bodies of the insects contained most color and fetched about 4s. per pound. Sifting resulted in legs and wings which fetched about 1s. 6d. About 1 ton a day of the indigo extract was used.

Aniline Dyes

Spirit Alkaline Blue was sent out by Simpson, Maule and Nicholson. It was usually dissolved by stirring the dyestuff into methylated spirits in a tall can immersed half its depth in a boiling dye vessel. The can was raised when it seemed likely to boil over. Alkaline Blue soluble in water was afterward sent out by Brooke, Simpson and Spiller. This was supplied in 10-pound tins, very neatly gotten up. We used the RR, B and 3B brands. The B brand was used to the largest extent, and on some days I dissolved 90 pounds of it in three lots in a 36-gallon tub, simply emptying the tin into the tub, pouring in boiling water, and stirring for ten minutes with a wood crutch. It dissolved at once and left no sediment. As we had the soft Halifax water, no soda was required, although this was specified in the instructions for use.

Violets could only be bought dissolved in spirit in 10-gallon drums. As far as I remember the makers were Simpson, Maule and Nicholson, afterward Brooke, Simpson and Spiller. Violets were very expensive and their use was limited to topping Alkaline and Royal Blue. Violets were later supplied in cake and powder form, soluble in water. The dyestuffs had a tendency to harden, even if kept in soldered tins, so that the tins had almost to be destroyed in order to obtain the contents.

We used to weigh out the required amount and dissolve it in a lading can; but as the Violets, especially Violet 3B, came more into use, and as I had to dissolve and prepare most of the colors for my father, who was the dyer at that time (a dyer of piece goods was called a pattern dyer), I asked if I could have a water and steam pipe fitted to a 20-gallon stone jar that I had discovered, so as to dissolve a few pounds at a time—4 pounds, I think. The head of the firm hardly approved this suggestion, but finally I got permission and all went well for a time, until one day the steam cracked the jar and a piece was blown out of the bottom, so that the solution was wasted. I had not expected this, and, of course, someone told the principal, who sought me out and said: "Now, you see the result of your cleverness!"

I said I was sorry it had happened, that is was a good and useful way, and asked if I could have a 36-gallon tub, of which we had plenty. The principal said, "All right, please yourself"; and so I got a tub and was pleased, I think, that he saw the idea was right.

At that time nothing was known of scents or flavors from coal tar, but when dissolving these Violets I could distinctly smell May blossom during the boiling. I asked some of the men whether they could smell the same scent, but they could not and said I was mistaken. Still, I felt confident I was right.

As the Violets came more into use there rose a great demand for Primula. This color had a long run and was very popular. It afterwards became so common that the color went entirely out of favor, being considered loud. It has revived to some extent during recent years. They used to say at home that whatever garments my father took to the works to dye came back Primula; and I do not wonder; the color was exceptionally good for not showing faded or nap worn places.

One large stone vessel was always kept for Primulas, measuring 5 feet 2 inches in depth, in length and width. The sides of the vessel were about 10 inches thick and the ends about 7 inches, while the bottom was about 14 inches thick. From these measurements it will be seen that the bottom of the cistern was about 8 feet square and, being 14 inches thick, was a heavy article. The cisterns were also very durable; but I remember the Primula cistern leaking during the night. Careful inspection showed the bottom to be cracked. A new bottom was decided on and a special piece of stone was ordered, which took a long time to obtain and prepare. It was also a task to get it into position, the dye works being somewhat lacking in space. Eventually the bottom was put in and the sides and ends placed ready for warming up.

My father wished the heating from cold to boiling to be very gradual and to occupy a week. This was agreed to, but after two days the principal inspected the vessel and decided that it was ready for firing up, as turning on steam was termed—being an old saying from the fire-pan days. So it was fired up and shortly afterward there was a loud bang and the new bottom, the work of months, was cracked just like the old one. Then there was some language used—an art in which our principal was gifted.

Boilers and Steam Pressures

In those days boilers were not built to stand much pressure. The boiler nearest the engine worked at a pressure of 30 pounds, and was only brought to this degree in order to drive the engine, as such pressure was considered to be dangerous. We younger hands were almost afraid to pass in front of it, fearing it might burst. The other four boilers worked at any pressure up to 16 or 18 pounds, and by breakfast time the pressure was usually brought down to 6 or 7 pounds and could not be got up again until after dinner.

While discussing steam pressures I would like to mention that the boilers of the Great Eastern steamship worked at 9 pounds' pressure, and even at that low pressure the main steam pipe burst and killed seven men by scalding. I have seen the pipe that burst. It was made like a boiler flue, of wrought iron riveted. We could see the patch covering the burst portion.

An Explosion

My grandfather, Robert Eastburn, who founded the Greenmount Dye Works, had the honor of having the first boiler explosion in Halifax. I do not know at what pressure it worked, but it blew up and two men were killed. The firing was attended by anyone who happened to be working near, the attention consisting of throwing coals on and raking up with a poker, which was certainly a very primitive way of doing things. The boiler had a hole in the front through which the water was drawn off. When the boiler was to be filled, a man got inside and fitted a plug into the hole. The plug was driven from the inside so that it could not blow out. To empty the boiler the plug was simply driven inward from the outside. From this custom the name of plug-potters arose. The plug-potters were starving men from Lancashire who wished to stay the progress of machinery, believing it to be their undoing. They would draw the plugs of boilers and thus stop the work. As a schoolgirl my mother remembered seeing these men march down King Cross Lane to Halifax.

Before my grandfather owned the works at which the explosion took place he had been stover and bleacher to the owner of a mill in Halifax, named Mrs. Hebden. The works were near to what is known now as Balmoral

Place. My grandfather wished to extend the business, but was unable to do so, as the district was a residential one. Finally, my grandfather was himself bought out by the landowners. He then migrated to Pellon Lane and commenced the dye works lately known as Greenmount Dye Works. Now, at that time there lived at Stannary Hall a fine old gentleman named Pollard who was a colonel in the yeomanry and had previously been a manufacturer. Among other goods, he manufactured slave cloths. These were made up at Stannary and exported to the West Indies. The warehouse and mills were at the back of Stannary Hall. The cloths used to be hung on tenters out-of-doors in the fields which then extended toward the Dusty Miller Inn in Pellon Lane.

Colonel Pollard did not like the dye works with the big chimney near his fields, for fear his cloths would be soiled by soot, so he was not very friendly disposed toward my grandfather. On the day of the explosion Colonel Pollard, while riding out on horseback, met my grandfather at the yard gate. He stopped, and the following conversation ensued:

Colonel Pollard: "Good morning, Robert."

Grandfather: "Good morning, Colonel."

Colonel Pollard: "I hear you had a blow-up this morning."

Grandfather: "Yes—it's a bad job."

Colonel Pollard: "Yes—I wish it had blown the boiler to ——."

Grandfather: "So do I, if you had been astride of it."

Colonel Pollard: "Good morning, Robert."

Grandfather: "Good morning, Colonel."

Colonel Pollard was a magistrate, and many stories are told of his masterful and short-tempered manner, swearing when on the bench at anyone who was in court. He once fined an uncle of mine for shooting a hare at Stannary, now in the center of the town, during a very severe winter, when the hare must have come so far down in search of food.

Power Winches

Many of the winches were set to run by power in 1872 or thereabouts, instead of being worked by hand. Shortly afterward the first piece dyeing machine made its appearance. It had a large wood-covered drum fixed high up and a separate small steam engine. The first machine was used for dyeing Spanish stripes in Royal Blue. Now, Spanish stripes was a very soft, loosely woven cloth with a nice nap. The drum being higher up than the old winches, the wet cloth stretched lengthways owing to its own weight plus that of the dye liquor. As these cloths were sent back to the maker in the wet state—simply cuttled—the makers were much surprised when the pieces began to finish several yards longer than before.

About this time also steam engines were first used for turning winches and also for single plates instead of by hand. I have often as a trial of strength turned a batch of pieces over the single plate by hand, and found it very hard work, especially at the latter end, when the drum got so big and the wet, hardened wrapper came at the end. The first engines were fitted to drive direct, but afterward by cog wheels.

Coal Prices

When the railways were made and brought coal to Halifax, the trucks were owned and run by the railway companies themselves, and they bought coal at the pit and brought and delivered it to the consumers. A merchant running his own truck to the colliery was not thought of. An uncle of mine, who was born in 1815 and lived to be ninety years of age, had a mill at Stannary about 1850. He had twelve months' contract with the railway company to deliver him engine coal shot down at Stannary for 2s. 9d. per ton. But after seven months the Government stopped the railway companies from doing this, saying that the railway companies must not be coal merchants.

This low price of 2s. 9d. per ton seems almost impossible, but at the time when I was apprenticed we had engine coals delivered in Halifax at 3s. 6d. per ton from the Liversedge district. When my father set up house in 1853 he had the best Flockton coal delivered to his house at 8s. a ton, and no charge for carting or housing unless it was a bad place, when a second man came and was paid a shilling a ton. This old Flockton coal was the finest ever known. I am sorry the seam was exhausted many years ago, for it was splendid coal, such as we have no idea of nowadays.

My father bought Flockton coal from the same merchant as long as the man lived. When the price rose to 14s. per ton delivered, he said: "It's not worth it, William, and I am ashamed to send you the note." What would the coal merchants say to-day?

Water Supplies

In those days there were no big corporation reservoirs and no supplies for trade mills, so mill owners and dyers had to provide their own water, either from a stream or by sinking wells. A shaft was sunk by my grandfather nearly 120 feet deep nearly opposite to the Dusty Miller Inn, and a pump was fixed which raised enough water to charge a 2-inch pipe. Besides this, he sank two shafts on some land he bought in the Mount Tabor Road, near where the race course was made, now the West End Golf Links. Besides the shafts, he ran a drift through a sloping field and got some splendid water out of the same hill as the Highroad Well spring comes from. This water he piped into a reservoir he made at Rushton Hill. This reservoir is now empty, and part of the embankment is being removed to widen Tabor Road. The water was conveyed in pot pipes down to Greenmount via the upper side of Pellon down through a narrow road, then through Donkey Lane, behind the present Rook Inn, and into Hanson Lane, and into a reservoir made near the big

chimney. The reservoir is at present used for storing coal and other materials.

Dyers' Secrets and Jealousies

Fifty years or so ago many dyers had their own methods of dyeing, recipes which they kept to themselves, and in order to keep their favorite wrinkles private they would not set any other foreman dyer who was out of a shop to work as laborer. My father was broader minded. At one particular time he had no less than five foremen dyers working under him as laborers until they could get foreman jobs again.

Bradford Market by Road

Before the railways were made, buyers and other business men went to the market by road and there was great rivalry on the road as to who could cover the distance quickest to, say, Bradford or Leeds. My grandfather would not be passed on the road by any other man. He always had good horses, and if any of the other business men should happen to have a horse to pass or beat his, Grandfather promptly got a finer horse. The best he ever had was an Irish horse named Paddy, widely known as the White Horse, and the fastest horse ever seen in the district. On one occasion, when it was urgent for Grandfather to get to the bank at Halifax quickly from Bradford, Paddy brought him from the New Inn at Bradford to the bank at Halifax, seven miles distant, in half an hour. Paddy's portrait was painted in the back yard of the Dusty Miller Inn, and after being lost to the family for nearly seventy years the picture is now in my possession, bought at auction by a lucky chance.

Highway Robberies

As the business men went to market by road, there were plenty of cases of robbery and assault. My grandfather was attacked and robbed, and so badly injured, by being thrown to the ground and knelt on, that he would never ride horseback again. Joseph Moxon Kirk, dyer, of Old Lane Dye Works, was attacked by a robber in Old Lane near to where the Crossley chimney now stands, then a very lonely place. Mr. Kirk just managed to throw his pocketbook over the wall into the plantation near the tunnel mouth, and fought for his life with the robber, whose little finger he bit off in the struggle. The finger was found in the road next morning. The pocketbook was also found in the plantation.

Dyers' Trips

These famous trips were started while I was an apprentice, but as the works were always busy it was not known until six or seven the previous evening whether or not the men would be allowed to break Saturday morning. Then there was a good run about to buy tickets. This trip went on for a good many years; and perhaps the war finished it, as it finished many other things.

The Big Chimney

My grandfather's works had two stone-built chimneys. I can just remember one being pulled down. The other still remains a good square chimney yet, although it must be eighty or ninety years since it was put up. When it was being put up it was spoken of as the Big Chimney, and people came up out of Old Halifax to see it being built. When Ingham Bros. began dyeing they built a very large brick chimney, which went out of use when the firm removed to Washer Lane Dye Works, and later was pulled down. I saw it pulled down and also saw its foundations.

Speaking of big chimneys reminds me of an experience of my own concerning a big chimney that was at Jonathan Smith's dye works, near Clark Bridge, where part of the gas works are now. Messrs. Smith gave up business and the premises were sold to the Halifax Corporation to make room for extending the gas works. The dye works were dismantled and the machinery, etc., sold by auction. I was present at the sale and the last lot offered was the big brick chimney, which had cost £700 to build. This being the last lot and the end of the sale, everyone gathered round to see how the chimney would sell and how much it would fetch. The following dialogue took place:

Auctioneer: "Now, gentlemen, we come to the titbit of the sale. This fine, large brick chimney, built at a cost of £700. You can all see it. What am I to say for it?"

A Ten-Shilling Chimney

A long silence ensued. The spectators looked first at the chimney, then at the ground, not daring to look at the auctioneer for fear he should take a look as a bid. No one spoke until a man called Akroyd, a machine broker, a well-known character, and perhaps thinking to give a start, suddenly called out: "Ten shillings."

Auctioneer: "It's yours" (very quickly—at the same time bringing his hammer down smartly). "Will you please take it away at once?"

Akroyd (with a sickly look): "All right."

All his friends crowded round him shouting: "Nah, then, Akroyd, you're gettin' a job on nah!"

And until Akroyd could make up his mind what to do with the chimney all was at a standstill, the corporation wanting the chimney out of the way and Akroyd not knowing what to do with it. Eventually the corporation architects altered their plans, thinking that after all the chimney could be brought into use where it stood and save the expense of a new chimney. They approached Akroyd to see what he would sell it back for. "Forty pahnds!" And eventually the corporation paid Akroyd £37 10s., so Akroyd came out of it well.

The cream of this story is that, owing to another alteration of the plans, the chimney could not be brought into use, and the corporation had then to pull it down for itself.

The Fletcher Trial

Early in 1876 occurred the famous trial of the two brothers, Bold Luke Fletcher and Randolph MacGregor Fletcher. They were brought to the bar under the worsted act for being in possession of small patterns of material taken off goods in process for future guidance in dyeing similar material. This was done by all dyers, and was not a case to be brought under the worsted act at all, being a well-known trade custom. The real reason for the prosecution was said to be resentment by the firm at the two dyers leaving their employ to commence business for themselves—to the ultimate regret of the old firm.

The prosecution was put into the hands of the worsted acts committee and their inspector, who, of course, wanted to make a big case of it. The two brothers were taken into custody early one morning, one from his work at the dyehouse and one out of his bed, and locked up, all being prepared and in train by the prosecution to try the prisoners that day and have them off to Wakefield Prison by 2 o'clock.

My father and myself were discussing the case at breakfast time, my father being much put about at the affair, when Mrs. Bold Fletcher came in an a very excited state, saying, "What am I to do, William?" My father told her to go and see Mr. Leeming, a noted solicitor at that time, and tell him to appear at court and apply for a remand. He applied and the case was adjourned.

When the case came on again the Fletchers had secured the services of Laurence Gane, a well-known Leeds barrister, who got the prisoners off with flying colors—simply demolishing the case for the prosecution. As the magistrates were retiring to another room to consider their verdict, Mr. Ingham wished to speak to them. The magistrates went back onto the bench to hear what he had to say. I was present in court and heard his statement:

"I wish to state that I have nothing to say against these young men. They and their father before them worked for me for a long time. The prosecution was not of my seeking. I did not expect it to come to this and I am very sorry."

After this—and my father having given evidence that the offense they were charged with was a trade custom extending back to olden times—there was nothing for it but to dismiss the case, to the great chagrin of the worsted inspector, who thought he had a good case.

Among the patterns were two or three pill-box samples of magenta crystals. These boxes were opened several times—and you know what small crystal magenta will do in that case. The worsted inspector had a light suit on. The magenta dusted onto his clothes. His hands got reddened, and, it being very warm in court, he perspired and kept rubbing his nose and face. At the close of the trial the effect can be imagined. Several officials and others in court also got magenta-ed.

Seven weeks afterward my father was sent for from home after tea to go down to the works. He was told that he had finished, and was given a fortnight's wages in lieu of notice. My father asked Mr. Ingham the reason. Mr. Ingham replied: "Thou went against us at the trial." My father answered: "Well, I was subpoenaed and I had to go to tell the truth." Mr. Ingham replied: "I am sorry; thou has been a good man for us, but we cannot help it now. We have made other arrangements."

This closed the interview and ended a service which had lasted from the commencement of the firm's business.

To avoid any further surprises all my father's books and patterns were hidden away at a friend's house.

Droll Characters

At that time a number of middle-aged, or what then appeared to me as old, men were engaged at the works. Many of them had been hand-wool combers and hand-loom weavers who by the advent of machinery found themselves thrown out of work in great numbers. To go into the dyehouses as laborers was their only resource, and as their number was great and their position desperate their labor was cheaply obtained. One large dyer used to say that he could get men out of Soderby at a shilling a yard. The explanation of this is that the men were of fine build, mostly over 6 feet in height. The wage paid was 12 shillings a week, or two yards of man per day for 2 shillings. I am speaking of a period of nearly seventy years ago. This man's place was called Dulefoot Dye Works—i. e., devil foot—though for what reason I do not know.

Many of the men were fine men, good chaps, wise and experienced owing to their hard bringing up. They could tell stirring stories of olden times, for they had suffered lives of great privation. When I was a boy the wages of these men were only 15 shillings a week to start with, rising to 16 shillings after a while, and not too soon at that.

One man, a Scot, and always called "Scotchman," was one day turning the swape, as the handle of the dye winch was called, when the principal, who was passing, noticed that he turned the winch rather slowly. This was of no consequence, as the winch only required to be turned quickly when entering the pieces. The following conversation ensued:

Principal: "Dusta know tha'rt robbing me?"

Scotchman: "How's that?"

Principal: "Turning that winch so slow."

Scotchman: "I don't know about that. You've been robbing me for many months."

Principal: "How's that?"

Scotchman: "Well, I get a shilling a week less than

the others; they get sixteen and I only fifteen for the same work."

Principal: "Oh."

He then walked away to the pay office and had the wages of each increased to 17 shillings. So the Scot and the others who had had 15 shillings got a rise of 2 shillings, which was considered a good lift in those days.

Another droll character was a man called Squinting Charlie, a big, clumsy man with a fearful squint. One day in the drug room, or Ware Hole as it was then called, I was telling a few of the men about a man who had tried to lift himself standing in two buckets, but could not raise himself from the ground. Squinting Charlie at once said that he could do it. He could "lift owt." He was a strongly built man. So we got two big buckets—they had to be big buckets, for Charlie's clogs were immense. He put a foot into each bucket and gave a terrific lift. I don't know what would have happened next, but just then one bucket handle broke, which ended the experiment, for one broken bucket was enough. But Charlie always maintained that he could have done it if the bucket had not broken.

Sleepy Tom was so called because he fell asleep at all times, even when turning the dye winch. He would suddenly stop turning and stand with the handle in his hand fast asleep until his mate bawled out, "Tom!"—when he would open his eyes and go on turning, only to stop again in eight or ten minutes.

Long George, Quiet Joe, Little Abe and a still smaller man called "Th' Giant" were curious characters. Another man, known as Pensioner, had served twenty-one years or more and had a pension of 1s. a day. Pie Bill, who used to bring a pie measuring a yard round for his dinner; Black Bill, who after a good dinner would go round the dining-room table and eat all the fat the other workmen left on their plates, were others. Old Smell, one more of them, as a young man worked at the indigo vats, and then went to South Africa and served for many years in the Cape Mounted Rifles, came home and found work at the indigo vats again. When he again smelt the peculiar odor of the vats he exclaimed: "The same —— old smell yet." Hence his nickname.

Another man was one day turning the winch very slowly as the principal was passing, and the following talk ensued:

Master: "Hasn't tha' another speed than that?"

Man: "Yoss."

Master: "Let's see it, then."

The man turns the winch *slower*.

Master: "I think tha'd better put thy coit on."

Man disappears in the steam as if dismissed and goes for coat, but shortly is back at his work again.

Master (passing again): "I thought I telled thee to put thy coit on."

Man: "Aye, but I thought tha' didn't mean it."

Master: "Go on withy wark, ya' ranghead."

Oates Ingham

Somewhere about 1850 Oates Ingham lived in the neighborhood of New Bank, Halifax, and when the dyers and marketmen were driving up New Bank on the way to Bradford or Leeds, Oates Ingham would come and stand in the highway with a few hanks of colored yarn that he had dyed in his small house and, waving it in derision, cry out to the dyers passing:

"Here, you chaps; beat that if you can, any of you! I am the proud dyer of the world."

"I am the proud dyer of the world"; he might well say that. He must have had great confidence, but could hardly have thought that he would in the future be owner of the largest dyehouse in the world—as it was said to be at the time—The Valley Dye Works at Bradford.

I think he must have been at Greenmount at one time, as his son, John Ingham, lived in Peel Street, Mount Pleasant. John Ingham lived to see Valley Dye Works after Greenmount was carried on by Edward and Benjamin Ingham under the title of Ingham Bros. Both being strong-willed men, they quarreled, and after fighting with dye sticks Benjamin Ingham went out of the partnership and commenced business at Eastbrook Dye Works, Bradford.

Edward Ingham took J. W. Ward into partnership, which was afterward dissolved, and Mr. Ward built the West End Dye Works. Afterward Edward Ingham retired and the business was carried on by R. D. Ward, who subsequently removed the dyeing business to the Washer Lane Dye Works.—Dyer and Calico Printer.

The Cartex Underwear Company, Reidsville, N. C., has been incorporated with a capital of $150,000 by William H. Carter, president, and W. L. Pannil, treasurer, and has purchased the plant of the P. H. Hanes Knitting Company at Reidsville. The plant will be equipped with machinery for the manufacture of men's cotton ribbed underwear, starting with a capacity of about 200 dozen a week. Mr. Carter is the president of the William Carter Company, of Needham Heights, Mass., and this company controls a majority of the stock of the Cartex Underwear Company.

The Standard Silk Corporation, Van Houten and Mill Streets, Paterson, have incorporated to carry on a business of dyeing, finishing, printing and bleaching silk and other textile fabrics, and right to use any and all processes necessary in the weighing of same. The capitalization is $1,000,000 and the incorporators are George W. Cole, Jr., and J. Vincent Barnitt of Paterson, and Jay Leigh Wolf of New York. It is understood that the company controls the patents of certain processes which they propose using on a large scale. George W. Cole, Jr., is also president of the Standard Silk Dyeing Company of Paterson.

Carpet Yarn Dyeing

Improvements Brought About by Modern Methods—The Designing Room—Straight Types of Dyes Are Preferred—Preparation of Carpet Yarns—Scouring—Open Tub Dyeing

By LOUIS J. MATOS, Ph.D.

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Note—This article, originally published in a previous issue, has since appeared in "Dyestuffs" with several important additions and changes.

COLORING of carpet yarns, and yarns for other kinds of floor coverings is, of itself, not a difficult matter in view of the equipment of modern dyehouses. Formerly, when the work was done in the old open dye tubs, the job was perhaps the most "sloppy" of any dyeing operation. At the present time, with improved dye kettles, the yarn is delivered in a very much better condition and decidedly more even in shade.

In dyeing yarns for the carpet trade, the dyer occupies a position to the designer that is relatively the same as that of a builder to the architect. The designer and architect prepare plans that are followed by the dyer and builder respectively. In designing carpets or rugs many conditions must be given consideration that lead to a finished fabric of harmonious design and in which the coloring of each of the design elements plays a most important part. In making the design the artist is constantly humoring his colors, shading and toning, until the completed pattern thoroughly harmonizes so that no one color appears more prominently than its neighbors.

Of course, there are carpet designs made for certain classes of trade, and in which strong and brilliant shades are demanded; then again, there are other designs that appeal to a somewhat different trade, and in which the colorings are more refined and subdued. All these different color effects are governed by the particular trade that the finished carpet is intended for. Another class of coloring largely affected in rugs is the so-called "Oriental" where the shades are so toned as to impart the appearance of age and antiquity.

The Designing Room

All these various colorings are worked out in the designing room and when the design is completed it is usual to have sample lots of yarn dyed and woven into patterns so that the designers and the selling force of the manufacturers may see what is under way. It is during the inspection of the woven sample pattern that a few points are to be finally determined. There may, and probably will be, some changes in the make-up of the colorings; a red is to be brightened, a pink slightly shaded with a blue, an olive toned with a little yellow, the ground color darkened or lightened, etc. Then the exact kind of yarn is to be determined to set off the figure to the best advantage; in this regard it is well known that the count and quality of the yarn play a most important part in the appearance of a carpet; in some instances a poor yarn, or one unsuitable may spoil what is otherwise a good design irrespective of the beauty of the individual colors.

Straight Types of Dyes Preferred

Most carpet yarn dyers prefer to use, whenever possible, straight types of dyes in preference to making mixtures, but it so happens that in many instances the shades selected by the designer are such that few straight dyes will suffice, and the dyer must then match his shades by compounding. The necessity calls for skill in dyeing of the very highest order. It is the aim of the dyer to cooperate to his fullest extent, with the designer, having in mind that the designer is the artist creating the pattern, and that the dyer is engaged in finishing one of the necessary parts of the completed work.

The choice of dyes for carpet and rug work need not be very extensive. A well selected range of base colors, with an assortment of shading colors, will usually meet the demands imposed on the dyehouse by the designer. Of course, not all dyers work alike; some deem it necessary to carry a rather full line of dyes, but during the past twenty years, the tendency has been to keep the number of individual types down to a minimum.

With a line of about twenty dyes, including black, scarlet, reds, blues, green, yellow, oranges, violet, rose, with a complement of dyes for shading, the dyer is usually able to duplicate any shade used in the pattern.

In this connection one of the most important contributions to the literature of practical textile coloring is the recent publication of the National Aniline & Chemical Company, Inc., treating on the dyeing of carpet yarn. This work shows a very complete series of thirty-six shades representing twelve dyes, followed by type dyeings of eighteen additional dyes, giving the dyer of carpet and rug yarns a wide range to choose from. In addition there is a most useful group of twenty-seven compound shades that in a most practical manner show the desirable mixtures for producing mode tones and other effects. These dyeings are all shown on actual pieces of carpet, and woven from yarn that was dyed in practice. Finally, a selection of thirty colors is given on yarn, thus enabling the dyer to form some idea as to how his dyeings will appear before going to the loom.

Preparation of Carpet Yarns

Carpet yarns may consist wholly of wool, or they may contain admixtures of wool and hair as used for the cheaper grades. Where hair is used in the mixture, the choice of dyes should include those that are easily leveling, and are applied by means of sulphuric acid and Glauber salt. This is generally necessary because hair, being less easily penetrated than wool, is likely to be left only in a partially dyed condition.

From the scours, the yarn should be bleached or sulphured. It is almost impossible for the dyer to produce clear shades unless the material is as white or light colored as possible. After scouring, the rinsing should be so thorough that no traces of soap remain in the wool. While the rinsing may not be as perfect as for piece goods, it should be so well done that all soap is removed. The chief reason for this is that any traces of soap remaining in the wool will be decomposed when the yarn enters the acid dye bath, causing a separation of the free fatty acid which adheres to the wool. When the carpet is made, if such fatty acid is in it, it will cause a softening of fibers and thus be responsible for footprints, etc. In other words, the wool in the yarn loses its elasticity.

Scouring

The first important treatment of carpet yarns is scouring. As a rule, the oils used in the picker house for this class of material are not of the same high quality as are usually employed for finer wools, and consequently their removal requires a somewhat more drastic treatment. Most carpet yarn scourers employ a strong soap solution frequently fortified with soda to insure the complete removal of the oils, but as often fail to wash or rinse the yarn afterward, as thoroughly as they should, the result being that appreciable quantities of soap remain behind. Strong soap solutions of the kind mentioned are not absolutely detrimental provided the temperature of scouring is kept below 120 deg. Fahr., but with the presence of soda, the yarn is liable to become somewhat harsh.

Only sufficient soap should be used in the yarn scours to effectively remove the oils at the indicated temperature and allowing proper time for the soap to do its work, conditions that require some experience and exercise of judgment. The main object is to deliver a clean yarn to the dyer, free from oils and soap, and without any injury to the wool.

Ground Colors

Level shades for ground colors are an absolute necessity, and for their production, slow dyeing should be resorted to. Any attempt to push the dyeing operation will only result in unevenness. The use of level dyeing dyes is recommended for the purpose, and the operation carried out with from 4 to 6 per cent of oil of vitriol and 20 to 25 per cent of Glauber salt. The dyestuff may be previously dissolved and added to the bath, the temperature brought to about 175 deg. Fahr., the yarn entered, and afterwards raised to the boil and boiled to shade. For standard colorings, the dyer may fix his formula, but even then, he will have to pass judgment on each batch. While dyeing in revolving yarn kettles, the dye solution is added directly to the bath as soon as the temperature reaches 175 deg. Fahr., after which it is raised to the boil, and boiled to shade.

Oriental shades, nearly all flat colorings, possess a peculiar charm in carpets that is greatly enhanced by the luster of the wool. These shades, as they exist in the genuine Oriental productions, are chiefly the result of artistic and weaving skill while the technique of the dyeing is secondary.

Facts gathered from various sources and confirmed by travelers from those regions where such carpets are made show that the dyer makes no effort to match his shades with any degree of accuracy. This accounts for the frequently noticed unevenness in the ground colorings. Several large rugs of excellent material recently examined show distinct differences in shades of design elements that would otherwise be made absolutely uniform in a carpet of modern manufacture.

Open-Tub Dyeing

The actual dyeing of carpet yarn is carried out in either the old-fashioned open tubs, in rotary dyeing machines, or in machines that are constructed to give the yarn the same motion that it has when dyed in open tubs. It must be said that with ordinary good labor and careful supervision, the open-tub method has never been excelled for the quality of the work turned out, but the improved types of machines have made possible a greater unit output of dyeings of very high quality. Formerly, when the old open tubs were exclusively used, handling the yarn was a very laborious matter; the worst feature was the constant turning of the yarn on the sticks, and the occasional "lifting" towards the end of the dyeing to permit the additions of whatever shading colors were necessary.

An increase in the number of American made stockings worn by the women of London has been noted in recent months, but in their demands the women of London differ considerably from those of America. For instance, where about 60 per cent of the hosiery sold in America is composed of black stockings, the latter compose only about 10 per cent of the English sales. Light colors, such as beige, sand, nude, champagne and gray, are the most popular in London. Plain stockings are being given preference over embroidered or clocked hosiery.

Foreign Trade Opportunities

Reserved information may be obtained from the U. S. Bureau of Foreign and Domestic Commerce and its district and co-operative offices by duly registered firms and individuals upon written request by opportunity number. The bureau does not furnish credit rating or assume responsibility as to the standing of foreign inquirers; the usual precautions should be taken in all cases, and where no references are offered it does not necessarily imply that satisfactory references could not be given. Correspondence may be in English unless otherwise stated. Symbols: *Reported by American consular officers; †Reported by commercial attaches and trade commissioners; ‡Direct inquiries received by the Bureau.

5896.‡—Textiles, including cotton and fancy staples—British West Indies. Agency.

5899.†—Cotton—Mexico. Representation of southern cotton firms.

5900.*—Woolen and cotton piece goods, haberdashery, automobile hood cloth, imitation leather, oilcloth, hosiery, finished leathers, and shoe laces—India. Purchase and agency. Quotations, c. i. f. port of India.

5912.‡—Textiles, confectionery, motor accessories, lubricants, electrical goods, novelties, etc.—Punjab, India. Agency.

5811.*—Dry goods, hosiery, waterproofs, handkerchiefs, etc., of the best quality—Sweden. Agency. Quotations, c. i. f. Swedish port.

5813.*—Textiles, cotton, seeds, foods, and soap—Italy. Agency. Quotations, c. i. f. Trieste.

5814.*—Cotton textiles, awnings, and hardware in general—Uruguay. Exclusive agency. Quotations, c. i. f. Uruguayan port Terms: Payment on receipt of merchandise. Correspondence, Spanish.

5815.†—Mercerized yarns, cotton twine, and cotton piece goods, finer counts—Argentina. Manufacturer's agency.

5816.*—Colored bath towels and bath mats—Netherlands. Purchase. Quotations, c. i. f. Netherlands port. Terms: Payment on receipt of goods.

5818.†—Textiles, especially white sheeting and shirting; and white, striped, and designed shirting flannel and Shaker flannel—Austria. Agency. Samples of the textiles desired were forwarded and may be examined at the bureau and district offices. (Refer to file No. 7572.)

5819.*—Colored drills, denims, ginghams, plaids, prints, bleached goods, gray sheetings and shirtings, osnaburgs, tickings, etc.—British West Indies. Agency.

5820.†—Cotton—Spain. Sole representation for Spain and Portugal.

5626.†—Textiles, cotton goods, and hosiery—Cuba. Agency desired by merchant who is now in the United States.

5635.*—Cotton-textile machinery, especially looms and machines for printing cotton textiles—Paraguay. Purchase. Quotations, c. i. f. Asuncion or Buenos Aires. Correspondence, Spanish.

5636.†—Silk and silk piece goods—South Africa. Sole representation of manufacturers desired.

5641.*—General merchandise, including cotton and woolen goods, silks, knit goods, hosiery, underwear, hats, neckties, perfumery, handkerchiefs, fancy dress goods, linen and silk cloth, and black bengal from 1.40 meters in width up, and hardware—Bolivia. Purchase.

5642.*Remnants of cotton and woolen goods, and silk goods of all descriptions, in very large quantities—India. Purchase. Quotations, f. o. b. New York.

5693.*—Cotton socks and stockings of the best quality, and silk and lisle stockings for women, in quantity of 1,000 dozen or more—Austria. Agency.

5694.*—Hosiery and knit wearing apparel—Denmark. Agency.

5695.*—Hosiery—France. Agency.

5696.*—Hosiery, ties, shirts, underwear, and other mercery lines—New South Wales. Quotations, f. o. b. American port. Terms: Cash against documents.

5697.*—Cotton piece goods, gray, bleached, printed, dyed in the piece, and dyed in the yarn—Egypt. Agency. Quotations, c. i. f. Egyptian port.

5699.*—Silk and cotton hosiery and knit goods—Denmark. Agency.

5698.†—Cottonades, prints, denims, duck, and cotton, artificial silk, and silk hosiery; boots and shoes for men and women; leather cloths suitable for garages and furniture manufacturers; unbleached calico; and

second-hand clothing—South Africa. Agency. Quotations, c. i. f. South African ports. Terms: Payment against documents.

5701.†—Cotton hosiery and vests—Australia. Purchase. Quotations, f. o. b. New York. Terms: Payment by letter of credit.

5704.†Bathing costumes and fancy bathing caps, and silk and artificial-silk hosiery—South Africa. Agency.

MORE THAN SCIENCE REQUIRED IN DYE MAKING

Manufacturer Needs Knowledge of Application as Well, Says Althouse Chemical Company

The importance of a knowledge of the art of dyeing as an asset to the dye manufacturer is emphasized in a bulletin entitled "The Art of Dyestuff Manufacture," published by the Althouse Chemical Company, Reading, Pa. This bulletin, which is the second of a series being issued by the company, states, in part, as follows:

"A great deal has been written about the chemistry, the science of synthetic dyestuffs. Little has been written of the art of making dyestuffs. Yet there is an art in making dyestuffs, just as there is an art in every technical industry.

"It is true that there is a distinction in one respect between the art of dye making, that is, in so far as the synthetic dyes are considered, and the average technical industry, in that a knowledge of the science preceded knowledge of the art.

"It is pertinent here to consider what is the essential difference between the science and the art of an industry. In one sense the art is the inclusive term. To say one has a mastery of the art of dyestuff manufacture implies one knows all that is required to produce a merchantable product, and this perforce includes a knowledge of the science. As there is a certain something required beyond the science to make the merchantable dyestuff, to make it uniformly and economically, that extra knowledge is what is called the knowledge of the art.

"So far as the average man is concerned, a dyestuff is not a finished product; it is in its applied form, as the dyed fiber or fabric that it has interest for the ultimate consumer. In the application of dyes to fibers, few but will admit there is far more are at the present time than there is science. Admitting this condition, the value of a knowledge of the art of dyeing to the dye maker is easily appreciated."

The Guaranty Silk Dyeing & Finishing Company, Ltd., St. Catharines, Ont., has practically doubled the capacity of its plant to take care of rapidly increasing business.

ALDEN ENGINEERING CO. REPRESENTING SOWERS IN PHILADELPHIA AND BALTIMORE

Announcement has been made by the Alden Engineering Company, Inc., engineers and manufacturers, 15 Park Row, New York City, to the effect that this firm has been appointed as Philadelphia and Baltimore sales representative for the Sowers Manufacturing Company, Buffalo, N. Y., manufacturers of the Dopp line of seamless jacketed kettles, mixers, vacuum and pressure apparatus.

C. C. BUCKLEY NOW SELLING FOR WAMESIT IN NEW ENGLAND TERRITORY

Charles C. Buckley has been appointed New England sales representative for the Wamesit Chemical Company, Lowell, Mass. Mr. Buckley has been well known in the textile and chemical trades for many years and has made a specialty of handling chemical products for textile use. His many friends will undoubtedly be glad to welcome the line he now represents, and which includes aqua ammonia, lactic acid, antimony lactate, sodium bisulphite, lactamine, iron liquor, acetate of iron, pyroligneous acid and sulphuric acid.

A new tank support, and other improvements, are under way at the plant of the Philadelphia Dye Works, located at G and Wyoming Streets. W. E. S. Dyer, well known in the textile industry, is the engineer.

The Kesite Chemical Company, New York, N. Y., has been incorporated with a capital of $25,000, to manufacture chemicals, dyes, etc. The incorporators are N. Kessel, H. Johnson and W. T. Sandall. The company is represented by D. K. Shappiro, 276 Fifth Avenue, New York.

The Hopewell Color & Chemical Company, Hopewell, N. J., has been incorporated with a capital of $50,000, to incorporators are Peter M. Horn, W. Herbert and Edward Jones, Model Street, Hopewell.

The American Chemical Products Company, 315 New Street, Newark, N. J., has filed notice of organization to manufacture chemicals, dyes, etc. J. William O'Connor heads the company.

Wool shipments at Montevideo from October 1, 1922, to January 31, 1923, according to a private estimate, by principal points of destination were New York (including wool for Boston and Philadelphia), 26,680 bales; Hamburg, 8,586 bales; Antwerp, 1,653 bales; Genoa, 1,624 bales; Liverpool, 1,316 bales; Netherlands, 1,269 bales; Dunkirk, 1,015 bales; other, 1,188 bales; total, 43,331 bales. Shipments for the corresponding period last year were 42,512 bales.

AMERICAN
DYESTUFF REPORTER

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

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A NEW IDEA IN TRADE ASSOCIATIONS

STATISTICS, the need of which not only the chemical industry but general industry throughout the country has long felt, are now being gathered through the co-operative effort of members of the Chemical Equipment Association, described at some length in these columns in a previous issue.

The membership of the Chemical Equipment Association, manufacturing the entire range of chemical equipment and materials employed internationally in such great industries as the manufacture of heavy and fine chemicals, of coal products, fertilizers, dyes, electrochemical and electro-metallurgical products, the ferrous and non-ferrous metallurgical fields, the petroleum, ceramics, paper, rubber, paint, leather, lime, soap, and sugar fields, in the manufacture of edible and essential oils, in the great range of food and animal products activity and in still other of the world's key industries, are in a uniquely strategic relationship to general business.

According to a statement made by Pierce D. Schenck, president of the Association, following a recent consideration of statistical activities by the board of directors, "Chemical equipment is in effect a barometric register of general industrial conditions both at home and abroad. In many ways the absorption of chemical equipment and materials is as reliable and specialized an index to general industrial conditions as the production of pig iron was considered before the war, or as the Federal Reserve Bank's discount rates are now regarded.

"It is not yet generally realized that the membership of the Chemical Equipment Association, now recognized by the Government and by industry in general as the speaking voice of American chemical equipment and materials manufacture, supplies essential equipment to practically every basic industry in the United States and abroad. There is scarcely an article of common consumption, in diet, in clothing, in transport, in the very essential and semi-essential accessories of life, that is not produced in some degree through the use of standard or special equipment and materials manufactured by the membership of the Chemical Equipment Association."

The association has now begun the monthly collection, through its members, of comparative statistics on the absorption of chemical equipment and materials by industries and by sections.

By industries, the information collected each month discloses the manufacturing field most active in the absorption of equipment and materials, the second most active, the third most active, and so on, both as to domestic absorption and foreign absorption.

By geographical sections of the United States, the information also discloses the principal concentrations of industrial activity in the way of replacements in factories, new construction operations and expansion projects of various sorts. The information further reveals general trade and business conditions of other sorts, as and if pertaining to the absorption of chemical equipment.

A charted summary of the information obtained each month is issued in confidential form to the member companies of the association, permitting them to co-ordinate their production and sales efforts with actual current conditions in the basic industries.

The activities of this body of equipment manufacturers, viewed in the light shed by recent and pending achievements, reveal that its workings are based upon what is virtually a new idea in trade association.

For fifty years there have been trade associations in the United States; one or two manufacturers' associations are of that age. Since shortly before the war, and with the increase most rapid, of course, during the war, there have come into existence some 5,000 American organizations classified as trade and industrial or allied associations until, as an article in a New York newspaper recently said:

"Industry has been wittily compared to the medical profession and to the labor unions—just as a consulting specialist will examine a patient as far down as the fourth vetebra, but no further, and a pipe fitter will fit a pipe but not perform the next operation, so even obscurely small process or manufacturing groups in industry are limiting themselves in organizations for combined self and public interest."

These associations, almost without exception, have been and are composed of manufacturers of a single product, as machine tools, lumber, coal, bread, etc.

The trade association motive and its distinguishing method, as represented by and expressed in these single-commodity organizations, have been and are quite obvious. The motive has been selfish—the promotion of the internal welfare of member companies or of the entire industry of which they are a member; and the method, the promotion of those companies' common product as

against some competitive product, the obtaining of legislative advantages for themselves as a group, the development of cost accounting methods for their more intelligent common action, etc.

In the last few years, however, the new idea has found expression. Its origin may be discovered in the equipment fields of a few important industries, and the idea itself is a reflection of an inherent relationship between industrial equipment of any sort, and the field or fields in which such equipment is used. This new idea has expressed itself in motives no less selfish than those of the older, more numerous type of trade association; but in its method is its novelty.

Equipment companies, except they are manufacturers of a single item of equipment, for instance, spark plugs for the automobile industry, or ovens for the baking industry, or tanks for chemically-based industries, have not among themselves the same things in common as have the manufacturers who, in any single industry, employ the diversified machinery, apparatus, and supplies which a representative group of their equipment companies produce. Automobile manufacturers, or wholesale bakers, or dye producers have identical problems, identical interests, throughout the whole range of their business because the product which they make is common to them all. But what of the companies who produce the manifold equipment that these manufacturers in single industries employ?

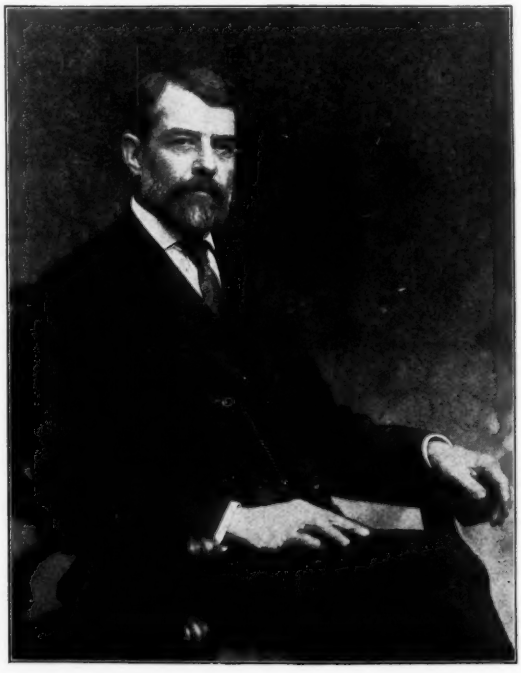
Their interests and their problems are not so common. In manufacturing, for instance, their problems are not universally alike, for one class of equipment may be based on iron, or steel, another on non-ferrous metal, another on wood, another on paper; one may depend on mechanical equipment, another on human craftsmanship; one on plant, another on science. In distribution only loosely are the interests of equipment manufacturers the same. One may distribute his product by registered parcel post; another may require a flat-car to move a single item. As regards cost accounting, costs and cost finding methods vary with the variety of equipment. As regards legislation one equipment producer may depend for his raw material upon a foreign country and a low tariff; another may require protection to make money. In one association successfully embodying the new idea in trade associations to-day, are members whose "plant" consists of a laboratory, a stenographer and a shipping clerk, and other members whose capitalization runs to $20,000,000 and whose factories and offices dot the entire country.

Obviously, an entire group of equipment manufacturers or, to put it another way, the manufacturers of the entire range of equipment essential to the life of any single industry, have just one broad thing in common, viz., their direct interest in that industry, or group of allied industries, which use their equipment.

So the new idea in trade associations, the idea being successfully exemplified in the Chemical Equipment Association to-day, comes down to this: Organization based on common interest, not in the promotion of a product common to a group of companies, but in the promotion of a group of altogether external industries which bear the relation to the members of the organization of buyer to seller.

ERNEST CHRISTIAN KLIPSTEIN

Ernest Christian Klipstein, secretary and treasurer of A. Klipstein & Co., president of E. C. Klipstein & Sons Company, and identified in an official capacity with half a dozen well-known chemical manufacturing or distributing firms, died Sunday, April 29, at St. Vincent's Hospital, New York City. He was seventy-two years old and is survived by his widow and three sons, Ernest H., Gerald P., and Kenneth H. Klipstein. Funeral services were held Tuesday afternoon, May 1, at his home, 93 Prospect Street, East Orange, N. J., with Rev. Charles Thomas Walkley, rector of Grace Episcopal Church, Orange, officiating. Interment was in Rosedale Cemetery.



E. C. Klipstein

Born of revolutionary stock in Marshall, Fauquier County, Va., December 24, 1851, he received his education at Roanoke College, from which he graduated with the degree of A.M. Several years of teaching followed, when a determination to take up the study of medicine caused his decision to enter the retail drug business in order to obtain a thorough grounding in the materia medica. It was for the purpose of completing his studies that he came to New York in 1875.

During the year previous he had chanced to make the

acquaintance of A. Klipstein, who in 1872 had established himself in New York as the selling agent of Edmond Renault & Co., and of A. Poirier & Co., both of Paris, and was subsequently employed by him as salesman. The business proved so fascinating and held out so many possibilities for development to a mind which was quick to grasp its potentialities, that the study of medicine was abandoned. The connection was continued with the result that in 1894, when the business was incorporated under the name of A. Klipstein & Co., E. C. Klipstein became treasurer. He took an active interest in the affairs of the corporation until his death.

E. C. Klipstein was internationally recognized as a pioneer in the truest sense; his innovational contributions to American chemical industry were the result of an outstanding ability to sense the technical value of chemicals and to exploit that value commercially. Especially was this true in the textile and leather fields, where his achievements and technical knowledge were most appreciated, his ideas were successfully adopted, and he was generally regarded as an authority. Indeed, it is doubtful if there is a prominent textile or leather man in the country with whom he was not personally acquainted. In the capacity of an expert, he was repeatedly called upon by both the House and the Senate committees for his testimony during the struggle to obtain adequate protection for the American dye industry.

Among his contributions to the American chemical industry were the providing of American dyers with vat colors; the substitution of formic acid for acetic and sulphuric acids in dyeing; the adaptation of sulphonating oils and the production of chrome acetate for calico printing; the use of tetra chloride of carbon as a non-inflammable solvent for grease and as a fire extinguisher (this article is marketed under the trade name of "Carbona" and has become nationally known to the country at large); the introduction of Quebracho Extract from South America, and of Mangrove Bark and Myrabolams from the Far East.

Incidentally, Mr. Klipstein's interest in the development of the dyeing industry prompted him to found E. C. Klipstein & Sons Company to manufacture colors, and this concern was one of the first successfully to manufacture Sulphur Black, as well as the first synthetic tanning material produced in America.

Other concerns with which he was identified besides those mentioned were the Bulls Ferry Chemical Company, the Carbona Products Company, the Manetto Company, and the Warner-Klipstein Chemical Company. Various other affiliations, and organizations of which he was member, were as follows:

The Reform Club; Drug and Chemical Club; Essex County Country Club, Orange, N. J.; Chemists Club in New York; the Society of Chemical Industry, London; American Chemical Society; International Association of Leather Trade Chemists; Merchants Association of New York; Manufacturers' Association; Chamber of Commerce of the United States; National Marine League, etc.

The Ionamines: For Acetate Silk

Affinity of Acetate for Basic Dyes—First Attempts to Prepare Special Class of Dyestuffs—The Omega-Sulphonic Acids of Amido Compounds—The "Ionamines"—Theory of Dyeing Acetate Silk —Ionamine B and Ionamine A—Dyeing Process—Diazotization and Development—Dyeing of Union Materials—Demonstration

By ARTHUR G. GREEN, F.R.S., and KENNETH H. SAUNDERS, B.Sc.

A Paper Read Before the Society of Dyers and Colourists, and Published in the Journal of the Society

THE variety of artificial silk known as "acetyl-cellulose silk," or "acetate silk," presents, by virtue of its water-repellent properties and the extreme fineness of filament to which it can be spun, qualities of great value and interest. It approaches in appearance and tensile strength more nearly to natural silk than any other variety of artificial silk yet produced. Unfortunately, these good qualities have hitherto been largely discounted by the difficulties encountered in dyeing the fiber, for it exhibits little or no affinity for direct cotton dyestuffs or for the majority of acid dyestuffs. The beauty of the material and the fascinating nature of the technical problem have led during the past two or three years to many investigations directed to overcoming these difficulties, and considerable progress has been achieved.

Affinity for Basic Dyes

At the time when the present authors took up the investigation of this problem, it was known that acetate silk exerted a considerable affinity for many basic dyestuffs, more especially in presence of inorganic salts such as magnesium chloride, zinc chloride, or sodium chloride (R. Clavel). A study of the subject conducted in the dyeing department of the British Dyestuffs Corporation some two or three years ago had also shown that certain oxy-azo dyestuffs which contain no sulphonic groups, such as *p*-nitraniline-azo-salicylic acid (Alizarin Yellow R) or picramic acid-azo-*m*-phenylene diamine (Metachrome Brown B), were taken up by the fiber, while it had been ascertained by W. Harrison, of Messrs. Bur-

gess, Ledward & Co., and by G. H. Ellis, of the British Cellulose Company, that a series of fast shades could be produced by dyeing acetate silk from a bath containing amidoazo bases in solution or suspension with subsequent development upon the fiber.

While, therefore, it was possible to dye a considerable range of individual shades by means of dyestuffs carefully selected from a variety of classes, there still existed no single class of dyestuffs having a special and selective affinity for this material. The position was, in fact, rather similar to that existing with regard to cotton before the introduction of the direct cotton dyestuffs.

First Attempt to Prepare Special Class

We were led to attempt the preparation of a special class of dyestuffs for acetate silk owing to investigations in which we have been engaged for the past two years upon dyestuffs containing oxy-alkyl radicles attached to nitrogen. It seemed possible that such dyestuffs by virtue of their alcoholic groups might exhibit an enhanced affinity for acetyl cellulose. We accordingly prepared and tested a number of azo compounds of this type, such as the following: Di-hydroxyethyl-diamidoazobenzene, $NH_2.C_6H_4.N_2.C_6H_4.N(C_2H_4.OH)_2$. Nitrobenzene-azo-di-hydroxyethyl-aniline, $NO_2.C_6H_4.N_2.C_6H_4.N(C_2H_4.OH)_2$. Benzene-azo-bis-dihydroxypropyl-aniline, $C_6H_5.N_2.C_6H_4.N(CH_2.CH(OH).CH_2OH)_2$ Although the simpler bases had on account of their solubility in water an affinity for acetate silk, this affinity diminished as the number of alcoholic groups was increased, thus disproving our hypothesis.

This initial failure necessitated a reconsideration of the conditions of the problem and its attack from a different point of view.

It would appear that the dyeing of acetyl-cellulose is in the main a solution phenomenon, the dyeing properties being conditioned by the following factors: (1) The presence in the dyestuff of amino-, substituted amino-, or hydroxyl groups. If, however, strong salt-forming groups, such as the sulphonic group, are also present, the affinity is greatly lessened or annulled. (2) When basic compounds are employed as their salts with acids, such as the hydrochlorides of dye bases, such salts must be readily dissociated by water, since it is the base itself and not the salt which is absorbed by the fiber. (3) The free base should be sparingly soluble in water. (4) The molecule should not be too large, since high molecular complexity tends to diminish solubility in non-aqueous solvents, and therefore in the fiber substance.

The problem of combining these conditions with ready solubility in water, and a simple method of application, was a difficult one. It could clearly only be solved by employing a soluble compound capable of splitting up in the dye bath with production of the sparingly soluble dye base. The methods at present employed of holding the dye base in solution by means of protective colloids, or by means of an excess of acid which is slowly neutralized during dyeing, are inelastic and difficult to adjust to varying conditions. They are also unsuitable for dyeing mixed fabrics of acetate silk and cotton or acetate silk and wool.

The Omiga-sulphonic Acids of Amido Compounds

We therefore turned our attention to a class of compounds which up to the present have met with very limited application in dyestuff chemistry. These are the omega-sulphonic acids of amido compounds, having the general formula, $X.NR'.CHR''.SO_3H$, in which X stands for a hydrocarbon nucleus, R′ and R″ for alkyl groups or hydrogen. Some dyestuffs having this structure have long been known, although apparently not brought into commerce; and the simpler colorless members of the class obtained by treating primary or secondary amines with aldehyde bisulphites, especially with formaldehyde bisulphite, have been described in a series of papers by Bucherer and others ("Ber." 39, pp. 2796 and 2814). All such "omega" sulphonic acids, in which the sulphonic group is situated by externally to the nucleus, possess the property being readily hydrolyzed by dilute acids or alkalis, although in neutral solution they are comparatively stable. When hydrolyzed they give rise to the corresponding amine or amido compound, together with the aldehyde bisulphite or its decomposition products:

$$X.NR'.CHR''.SO_3 + H_2O \longrightarrow X.NHR' + CHR'' < \begin{matrix} OH \\ SO_3H \end{matrix}$$

For example, aniline-methyl-omega-sulphonic acid, $C_6H_5.NH.CH_2.SO_3H$, is hydrolyzed to aniline and formaldehyde-sulphurous acid.

It was therefore anticipated that if the hydrolysis of a suitable dyestuff containing an omega sulphonic acid group were effected in the dye bath in the presence of acetate silk, the latter would be dyed by the insoluble dyestuff base as it was liberated. Accordingly azo dyestuffs were built up, depending for their solubility in water solely upon the presence of omega-sulphonic groups, while other sulphonic groups were excluded from the structure. The results corresponded completely with our anticipations. The dyestuffs were easily soluble in water, and behaved in general like ordinary acid dyestuffs. On the other hand, they dyed acetate silk readily from a slightly acidified bath, or one rendered slightly alkaline, less readily from a neutral bath. The acetate silk so dyed contained the compound as free amido-azo base, as was proved by the fact that the latter could be diazotized upon the fiber and coupled with phenols or amines. Thus, the methyl-omega-sulphonic acid of amidoazobenzene, $C_6H_5.N_2.C_6H_4.NH.CH_2.SO_3H$, gives upon the acetate-silk

fiber amidoazobenzene itself, which, when coupled, produces the appropriate disazo compounds.

The "Ionamines"

This preliminary success* led us to prepare and investigate a large number of new dyestuffs belonging to this class, a selection of which are being introduced into commerce by the British Dyestuffs Corporation under the name of "Ionamines." Those Ionamines, which are derived from primary amido compounds, or certain free amido groups, are capable of being diazotized upon the fiber, and in combination with various developers produce a wide range of shades from orange to scarlet, red, maroon, violet, blue, and black.

Those which are derived from secondary amido compounds are not diazotizable, but may be employed for direct shades. These latter are limited at present to yellow, orange, and red. All the Ionamines selected for employment dye‡ acetate silk readily from a slightly acidified bath, or one rendered slightly alkaline, at temperatures of 65 and 75 deg. Cent., at which temperature the fiber retains its full luster. The exhaustion of the bath is very satisfactory, and the color penetrates and levels well if care is taken not to raise the temperature too rapidly. The affinity for the fiber is remarkable, and either light or heavy shades may be obtained. The range of color obtainable is still further extended by the fact that one Ionamine may be mixed or shaded with another, since they have very similar dyeing properties. The suitability of compounds of this class to act as dyestuffs for acetate silk appears to be limited by two factors—viz., (a) The omega sulphonic derivative must be sufficiently soluble in water, for if precipitated in the bath it will escape hydrolysis. (b) The hydrolyzed base must be sufficiently soluble in acetyl cellulose. Too high a degree of molecular complexity may render the base too insoluble in the fiber substance. It has been observed that compounds of the omega-sulphonic-acid class which possess an affinity for cotton have a smaller affinity for acetate silk, whereas those Ionamines which have the highest affinity for acetate silk have none for cotton. We have also noted the curious fact that wool behaves entirely differently from acetate silk towards these dyestuffs, for whereas in an acid bath in presence of acetate silk the Ionamines undergo hydrolysis and the base is taken up by the fiber, this does not occur to a material extent with wool, which in great part becomes dyed by the unhydrolyzed sulphonic acid, as by an ordinary "acid" dyestuff.

*In a private communication W. Harrison informs us that he had also prepared and used some omega sulphonic acids for this purpose, but did not pursue the matter beyond preliminary trials.

‡The dyeing process is protected by British Patents Nos. 7980 and 23,543 of 1922 (British Dyestuffs Corporation, Ltd., Green, and Saunders). The preparation of new dyestuffs of this class is covered by British Patents Nos. 9792 and 25,989 of 1922 (British Dyestuffs Corporation, Ltd., Green, and Saunders).

Theory of Dyeing Acetate Silk

The dyeing of acetate silk can, in general, be most easily explained on the solution theory. Nearly all substances which dye this material readily are soluble in benzene or other hydrocarbon solvents. This is well illustrated by shaking an aqueous solution of Ionamine A with benzene. In the cold the water is yellow and the benzene colorless. Upon warming and shaking the benzene eventually becomes yellow and the water nearly colorless. In an aqueous solution an aryl-omega-sulphonate is in equilibrium with the base plus aldehyde bisulphite, the balance being greatly in favor of the omega-sulphonate, but in presence of benzene this balance is disturbed, the base passing into the benzene. Acetate silk resembles benzene in that it absorbs little water when wetted. Also the interface, like that of water-benzene, acts as a semi-permeable membrane permitting the passage of the base but not of aldehyde-bisulphite. The hydrolysis is thus greatly increased, since the basic phase is continually removed by solution in the acetate silk, while the action of the interface as a semi-permeable membrane in not allowing formaldehyde bisulphite to follow, prevents the establishment of equilibrium until practically the whole of the base has been transferred to the silk. Once within the silk the bases are firmly held, and hence show excellent fastness to soaping, washing, perspiration, etc. The case of wool is entirely different. Here water passes readily into the fiber, while the wool substance, owing to its basic components, possesses a natural attraction for the omega-sulphonic acid. The latter is therefore taken up as such, and hydrolysis is rather retarded than accelerated.

Ionamine B and Ionamine A

Before proceeding to a detailed description of the dyeing processes, it should be mentioned that the Ionamines which have so far been produced may be divided into two classes—viz.: (1) Those containing one salt-forming group within the molecule, the type of which is Ionamine B. (2) Those containing two salt-forming groups, the type of which is Ionamine A. The former have greater stability to hydrolysis. When dyed they are but little affected in shade by organic acids.

The latter are more easily hydrolyzed. They can be dyed with formic or oxalic acid, but will also give a fair degree of exhaustion when dyed from a slightly alkaline bath (addition of sodium carbonate or sodium acetate) or even from a neutral bath. When dyed they are readily changed in shade even by dilute organic acids, and are therefore unsuitable as self-shades, although when diazotized and developed they give deep and fast colors.

It will be seen from what has been said that the dyeing operation cannot be compared with the dyeing of cotton with direct colors or of wool with acid colors. It involves a chemical change. For this reason there is no possibility

of leveling up an uneven shade by longer heating in the bath, as is the case with cotton or wool dyeing. It is therefore advisable to enter the material at a low temperature and then gradually heat up. Although dyeing occurs to some extent even in the cold, the greatest affinity is exerted between 65 and 75 deg. Cent. It is not advisable to go above 75 deg. Cent. for fear of injuring the luster of the silk. The concentration of the dye bath can vary within very wide limits—say, from twenty times the weight of the silk to 100 times—the degree of exhaustion being apparently but little affected. The addition of salts to the dye bath does not assist exhaustion, and is not recommended, except in dyeing acetate silk and cotton unions with a mixture of Ionamine and a direct cotton color.

Although the Ionamines will dye from a neutral bath, hydrolysis, and consequently dyeing, are facilitated by the presence either of an acid or of an alkali. Usually about 1 per cent of formic acid, or 1 per cent of soda ash, calculated on the weight of the silk, is added to the dye bath. In dyeing twisted cord from an acid bath it is advisable to work neutral for some time before adding the acid.

(To be concluded.)

NOTES OF THE TRADE

A. W. Gay, formerly of the Euston Process Company, Scranton, Pa., has joined the staff of the Smith Chemical & Color Company, 257 Water Street, New York.

Switzerland's exports of coal-tar dyes in 1922 amounted to 3,872,800 kilos, valued at 55,257,000 francs, compared with 3,706,700 kilos and 57,676,000 francs in 1921. (Kilo equals 2.2046 pounds; Swiss franc, 19.3 cents par.) The United States took 711,300 kilos, 90,000 kilos of which came in during the last quarter, the sharp drop being attributed to the new tariff bill in September.

There are now about 200 looms in operation in Calcutta on jute cloth used for cotton bales. The mills operating these looms are American owned and were initiated as an experiment. It remains a question as to whether the new tariff on imports of this cloth into the United States will permit the expansion of this line of manufacture in India.

Estimates place the average daily production of artificial silk in England and on the Continent at the following figures: England, 15,000 pounds; France, 30,000 pounds; Germany, 35,000 pounds; Switzerland, 20,000 pounds; Netherlands, 4,000 pounds; Italy, 20,000 pounds; Poland, 2,000 pounds; Belgium, 25,000 pounds.

AMERICAN DYEWOOD COMPANY OPENS NEW OFFICES

On April 23, 1923, the American Dyewood Company, formerly of 80 Maiden Lane, New York City, opened new offices in the Pershing Square Building (the new twenty-seven story office building), at 100 East Forty-second Street, New York City.

DU PONT ANNOUNCES PONTACYL LIGHT YELLOW 3G

Pontacyl Light Yellow 3G, a product of greenish cast and of extreme fastness to light and great brilliancy, is now being offered by the Du Pont Company.

The color is very adaptable for the woolen trade and for the manufacture of color lakes, and it should be welcomed by the trade which it is intended to serve.

The Tucker Chemical Manufacturing Company, Paducah, Ky., recently organized with a capital of $250,000, to install and operate a local plant for the manufacture of dyes and textile chemicals.

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New towel mill with bleachery and finishing plant. Located in western New York. Can be bought for $100,000.00.

Address Box 227, care of the American Dyestuff Reporter, 4109 Woolworth Building, New York City.

WANTED—Copies of the February 26, 1923, and February 12, 1923, issues of AMERICAN DYESTUFF REPORTER. Owing to extra demand, our file copies of the above issues have been exhausted. Anyone willing to part with one or more of these copies will confer a favor by addressing this office. AMERICAN DYESTUFF REPORTER, 4109 Woolworth Building, New York City.

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